2/23/2000

Code 580 Rev E

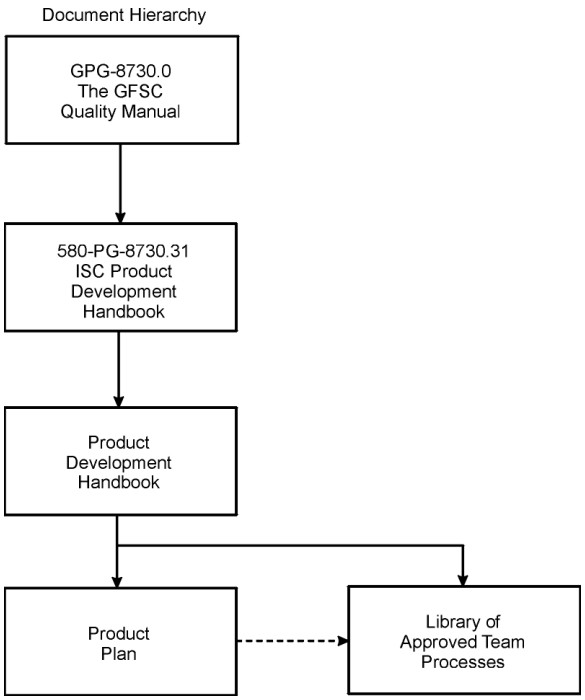
Information Systems Center

Controlled documentation is available on-line at

http://isc.gsfc.nasa.gov/Iso9k/pdh/PDH.pdf

It is the user's responsibility to verify that the version of any printed documentation matches the on-line version. This document is referenced by 580-PG-8730.3.1.

Product Development Handbook



Signature on File

Approved by: Martha Szczur

Chief, Information Systems Center

Preface

The Information Systems Center (ISC) Product Development Handbook is under ISC configuration control. Approved changes to this document should be listed on this page as follows:

Revision	Section	Description of Change
A	1.1	GSFC Quality Policy, scope now listed by reference to GSFC ISO web page
A	1.4	Deleted
A	2.0	Roles & Responsibilities updated to respond to changes in GPGs
A	3.0	Roles & Responsibilities updated to respond to changes in GPGs
A	3.1	Clarification of Product Plan scopes
		Updated definition of Quality Planning Document
A	6.1	Deleted
A	6.2	Roles & Responsibilities updated to respond to changes in GPGs
A	6.2	Library Modification Process updated
A	Appendix B	References to appropriate GPGs added
A	Appendix C	Team Organization Chart added to Product Plan Table of Contents; GPG references added
A	Appendix D	Updated Quality Records list and Instructions to respond to GPG changes
A	Appendix E	Mandatory metrics simplified
A	Appendix G	Roles & Responsibilities updated to respond to changes in GPGs
A	Appendix I	Web addresses updated
B	3.0	Roles & Responsibilities updated to add Statistical Techniques requirements and clarify NCR reporting requirements
B	Appendix B	Aligned Required Team Process Criteria names with the names used in the Library of Approved Team Processes
B	Appendix C	Updated to document statistical techniques needs of ISC & to add Handbook version to Table of Contents
B	Appendix E	Mandatory Metrics revised
B	Appendix G	Added Statistical Techniques Requirements; Clarified NCR reporting Requirements

Revision	Section	Description of Change
C	All, I	Updated URL references
C	Title, 1.1	Removed PG number, replaced with revision letter
C	All	Updated GPG titles and reference numbers
C	6.1	Updated configuration management process
C	Appendix A	Added mapping of Product Plan to ISO 9000-3
C	Appendix C	Updated Product Plan instructions
C	3.1	Updated customer agreement requirements
D	All	Updated reference GPGs
D	Title page	Updated reference PG, added document traceability diagram
D	All	Updated training requirements for management and Team Lead
D	Appendices	Reordered all appendices and deleted Appendix F (Customer Involvement Considerations)
E	Appendix A, B, E	Major revisions
E	Appendix F	Appendix F deleted, Appendix G, H re-lettered as Appendix F, G, respectively
E	All	Editorial changes to improve clarity

Changes or questions concerning this document should be addressed to the ISC/ISO Representative.

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ISC Product Development Handbook

1.0 Scope of Document

This document is intended for use by ISC personnel working with or without contract support to produce a software product for a customer. It does not include services such as consultation or management oversight of contractor development activities. When working for projects being directed outside ISC, ISC personnel and support contractors shall follow that project's processes except as delegated to ISC by the project manager.

1.1 Purpose

This document is intended to serve as a single reference guide which describes the ISC end-to-end processes for providing software products to our customers. These processes are consistent with the GSFC Quality Manual (QM) directive (GPG 8730.3) and Directives and Documentation Management (GPG 1410.1). References to the QM will be shown as "(QM 4-x)" where relevant. Detailed documentation associated with the GSFC ISO 9001 Quality Management System (QMS) may be found on the Web at:
http://arioch.gsfc.nasa.gov/iso9000/index.htm

The current versions of this handbook may be found on the Web at the following URL:
http://isc.gsfc.nasa.gov/Iso9k/pdh/PDH.pdf

Each version will be dated and will contain a revision letter. Notification of updates will be made via e-mail to all Code 580 personnel and Document Configuration Manager.

1.2 Definitions

- **Customer**: Any individual, group, or organization that receives and/or pays for a product or service, or arranges to have the product or service provided
- **Project**: A collection of a Team Lead and Team formed to assemble and deliver a product that satisfies an order
- **Product**: The output of a project that fills a customer's order
- **Order**: The description of the product that ISC agrees to deliver to the customer
- **Team Lead**: A qualified individual assigned responsibility and given authority to ensure that the Team fills an order (In the GSFC Quality Manual, this is equivalent to the Project Design Lead)
- **Team**: One or more qualified individuals assigned to a project, who work at the direction of the Team Lead in filling a customer's order (in the GSFC Quality Manual, this is equivalent to a Project Design Team)
- **Product Plan**: A description of the work to be performed and the resources needed to accomplish the goals and objectives established in the customer agreement (Appendix A)

- **ISC Management Team**: Includes the ISC Chief, and Associate Chiefs, Assistant for Technology, Institutional Support Manager, Senior Staff Engineers, Senior Administrative Officer, Senior Resource Analyst, Branch Heads and Associate Branch Heads
- **Resources**: Supplies needed to fill the order such as skilled people, money, facilities, etc.
- **Qualified Individual**: One who is capable of performing assigned tasks on the basis of appropriate education, training, and/or experience.

ISO 9001 in Brief

An ISO 9001 compliant organization has in place a quality management system that ensures quality is built into each of the processes throughout the organization. This requires that we must:

SAY IT!

Document what we say we are going to do

DO IT!

Exactly as we said we would

PROVE IT!

That we did what we said we would

IMPROVE IT!

That we take every opportunity to make our processes better

1.3 Business Development Process Overview

The overall process, known as the **Business Development Process** (Figure 1.1) is composed of a number of subprocesses, the first of which is the Strategic Implementation Process. The output from the Strategic Implementation Process is the Information Systems Center (ISC) Strategic Implementation Plan, which is, aligned with the AETD, GSFC and NASA strategic plans. The information from the ISC Strategic Implementation Plan is input into the Yearly Action Plan Process to produce an ISC Action Plan for the current year that includes near term ISC goals and objectives. The high level ISC Business process consists of six main subprocesses.

- Strategic Implementation Planning Process
- Yearly Action Planning Process
- Business Selection Process
- Order Fulfillment Process
- System Support Process
- Assessment Process

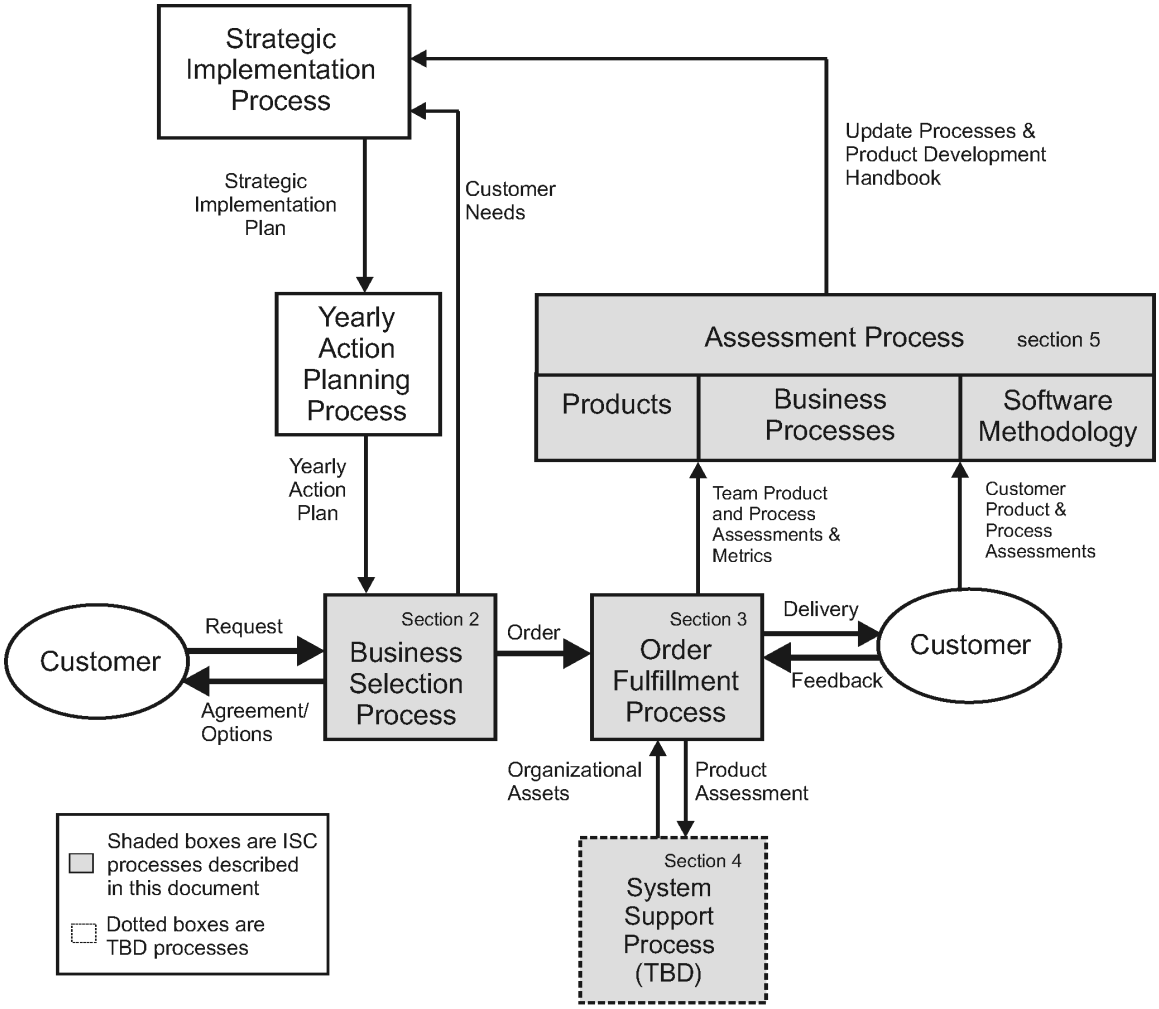


Figure 1.1 Information Systems Center Business Development Process

This document focuses on the processes directly associated with fulfilling a customer's product order (designated by the shaded boxes in Figure 1.1).

The **Strategic Implementation Planning Process** continuously and systematically reviews and evaluates ISC's mission, vision, and strategic goals; and ISC's success in meeting organizational objectives and customer feedback. Based on analysis, the ISC Management Team determines the organization's future and focus for time, energy and resources. Also, within this process, the ISC Management Team evaluates the organization's progress in meeting the objectives, and assessing the state of ISC's alignment with the NASA and GSFC's strategic objectives. The output from this process is the updated ISC Strategic Implementation Plan that may periodically validate the existing plan, or may revise the plan to reflect changes and refinements in the strategic direction. The Strategic Implementation Plan may be found on the web at TBD.

The **Yearly Action Planning Process** uses the Strategic Implementation Plan as the guide to define key business results (over the next year) associated with meeting each of the ISC strategic objectives. The actions defined in the Business Plan identify milestones and team lead for each action. ISC uses this plan to measure its success in meeting its annual goals. The action plan may be found on the web at TBD.

The **Business Selection Process** (Section 2) describes the processing of a customer's request, and if accepted, selecting the Team and Team Lead to complete the order. When a customer requests a specific product of ISC, the ISC Management Team determines whether to accept the request by using the Business Selection Process and the Action Plan, or to present alternatives to the customer. The Business Selection Process also requires logging or recording all customer requests, whether accepted or rejected. Recording the request closes the process loop and serves as feedback into the Strategic Planning Process. If the order is accepted, a Team Lead and Team are selected to work with the customer to provide the requested product using the Order Fulfillment Process.

The **Order Fulfillment Process** (Section 3) describes the processes to produce the requested product, beginning with the logging of an order and continuing through to delivery. This section also details the contents of the Team Product Plan.

The **Team utilizes the System Support Process (Section 4)**, where appropriate, to facilitate delivery of the product. The System Support Process effectively represents the organizational assets of ISC that can be used to fill the customer order. The Team also provides products; product assessments and lessons learned to the System Support Team for organizational retention. At this time, this process is TBD.

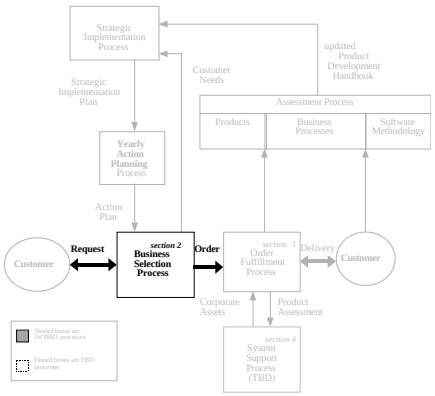
The **Assessment Process** (Section 5) is used to evaluate the product development process and the products in order to improve both. The Team provides assessments for Business Process, Software Methodology, and the product. In addition, the customer supplies an independent assessment of the process and product. Appropriate information from this process is used to update the Product Development Handbook and is also used as input to the Strategic Implementation Process.

1.4 Operating Structure Overview

- ISC will form a Team to fill ALL customer orders (Note: A Team may consist of one person).

- Product Plans are written for all products covered by this handbook.
- Metrics for both the processes and products shall be collected and analyzed for project management, process improvement, and quality assurance.
- Team progress is evaluated using metrics.
- The customer and the Team agree upon content, formality, and number of reviews.
- ISC Management Team will work with the Team Leads to ensure the product meets the customer's needs.
- The Team Lead has responsibility, accountability, and authority for the quality of the product delivered, and the responsibility to identify issues and concerns to the customer and appropriate ISC Management Team member.

2.0 Business Selection Process



Overview

The ISC Management Team has the primary responsibility for initiating and completing this process which begins with the reception of a request for software from a customer and ends with the selection of a Team Lead and Team to fill the order for those requests accepted (Reference Figure 2.1).

Roles and Responsibilities

Below are listed the roles and responsibilities associated with this process. Team and Team Lead roles have been expanded upon in Appendix C.

ISC Chief

- Ensure a Team Lead is identified.
- Ensure the Team Lead and Team consists of qualified individuals.

ISC Management Team

- Develop individual skills, Team skills and centers of expertise.
- Select and provide qualified Team Leads and Team members.
- Define the Team and Team Leads responsibility, authority and accountability for delivering quality products.
- Document any “required” training needs or On the Job Training (OJT) of employees in accordance with GPG 3410.2.
- Ensures that training received using funds other than GSFC training funds is documented either in the employee’s official or unofficial personnel folder.

Team Lead

- Meet with the customer to understand and document the product requested.
- Present to the ISC Management an estimate of the staffing and skill levels, and approximate time commitments required to meet the customer’s request.

- Assess the skills and expertise needed. Work with the ISC Management Team to select an appropriate qualified Team to ensure that the individuals are qualified to perform their assigned responsibilities.
- Maintain a list of any "required" training needed and received by team members
- Assign work to Team members.

Location of Employee Qualification Records

- Team Lead and Team members basic qualifications to perform their job derive from their meeting the criteria specified in their Position Description (PD) that are kept in their personnel folders.
- Team Lead and Team members training achievements requested via GSFC training forms are kept in their training records in Office of Human Resources (OHR). All others are kept either in the employee's official or unofficial personnel folder.
- Team Lead also maintains records of "required" training for Team members.
- For those Team members or Team Leads who are new hires or have been reassigned after 1/4/99, On the Job Training will be documented by the supervisor per GPG 3410.2.
- Specific QMS management and Team Lead requirements related to employee training and qualifications may be found in GPG 3410.2.

Ideal Output of Process Is:

- Clearly defined communication channels
- Full alignment with ISC/GSFC strategic objectives
- Customer satisfaction
- Quick response to request
- Clear, mutual understanding of customer's goals and schedule
- Flexible solution options with clear, unbiased tradeoffs
- Timely, accurate customer profile and needs information for ISC planning purposes

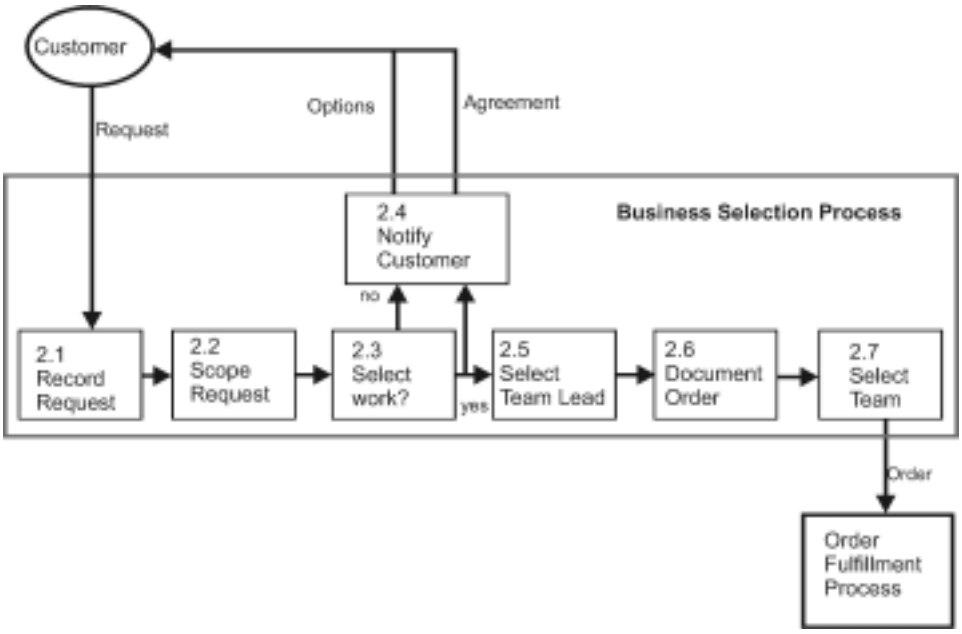


Figure 2.1 Business Selection Process

2.1 Record Request

- Anyone, internal or external to the ISC, may request ISC products. Requests may originate formally, such as through the issuance of Statements Of Work, or informally through conversation and phone calls. Any ISC employee may act as this initial Point of Contact in such requests for products.
- Initial product request documentation and subsequent initial ISC Management notification of such product requests is the responsibility of this initial Point of Contact employee. Documentation may take a range of forms, but generally an e-mail shall be formulated and forwarded to Branch management or higher. Such documentation shall include the name and organization of the individual requesting products, the date of the contact requesting these products, a description of the products requested, any information on schedule, staffing, funding, etc., and any other related information thought useful. In initial discussions the ISC employee shall outline the ISC process and set a target date for ISC follow-up contact back to the product request originator.
- Following Branch/ISC management notification, the ISC Management Team shall select an ISC Point of Contact to iterate and clarify this product request with the originator.

2.2 Scope Request

- The ISC Point of Contact shall further explore the product request with the customer and scope the work being proposed. This may involve the Point of Contact arranging meetings involving other ISC civil servants and/or contractors as appropriate. The Point of Contact shall document customer

discussions and agreements in electronic form to serve as a basis for customer review, update, and concurrence.

- The ISC Point of Contact shall work with the customer and the ISC to establish a top-level schedule and to provide a rough estimate of resources (people, money, facilities, etc.) needed to provide the requested products.
- The ISC Point of Contact shall actively involve the ISC Management Team in the resolution of any identified issues, such as questions of feasibility, work appropriateness, resources, etc.

2.3 Select Work

- The ISC Management Team holds the responsibility for agreements to provide customer products.
- The ISC Management Team, supported by the designated ISC Point of Contact, shall decide whether to proceed with the work or reject the work, based on a range of factors, including ISC Strategic Implementation Plan & Yearly Action Plan criteria, request prioritization against other product needs, GSFC mission priorities, available resources, etc. (long sentence)
- The ISC Management Team shall work with the ISC Point of Contact to briefly document the basis for the ISC "Go" or "No Go" decision.

2.4 Notify Customer

- The Point of Contact, and when appropriate, an ISC Management Team representative shall meet with the customer to discuss and affirm the ISC "Go" or "No Go" decision.
- When limitations within the ISC preclude the support desired to develop the requested product, the ISC shall work with the customer at exploring other alternative solutions.

2.5 Select Team Lead

- ISC Management Team shall be responsible for selecting the Team Lead to provide the product requested.
- Depending upon the nature of the support needed, selection may be made through a variety of processes, including Branch level assignment, ISC wide e-mail interest solicitations, or formal personnel actions.
- Customer participation shall be encouraged in the Team Lead selection process.

2.6 Document Order

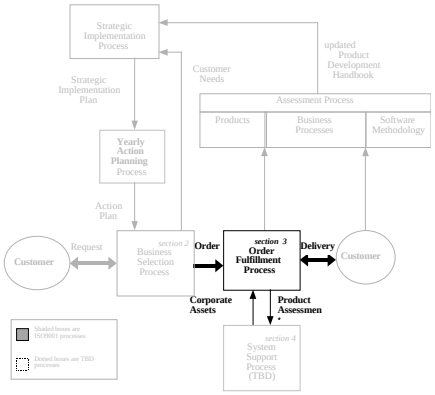
- The Team Lead shall be responsible for documenting the details of the product request and the general plan for meeting this request in the framework of the Product Plan. Specific Product Plan sections required are: 1.3, 1.4, 1.5, 1.6, 1.11 and 1.12 listed in Appendix A. (The remaining sections of the Product Plan are completed and the plan signed in the Order Fulfillment Process.)

- The order must be a signed Customer Agreement, which should either specify the requirements directly or refer to where the requirements are documented. This agreement could be accomplished by having the customer sign the Product Plan. In formulating this documentation, the Team Lead shall make maximum use of the ISC Point of Contact documentation and knowledge. Efforts in this Order agreement elaboration and negotiation shall involve other ISC employees and contractors as appropriate.

2.7 Select Team

- The Team Lead and ISC Management Team share responsibility in Team staffing.
- Team staffing, as for the Team Lead selection, may be made through a variety of processes, including Branch assignment, ISC-wide e-mail interest solicitations, or formal personnel actions.
- Customer involvement in Team selection is generally more a matter of concurrence than active participation.

3.0 Order Fulfillment Process



Overview

The Team now has the responsibility for completing the Order Fulfillment Process. This process begins with the continuation of detailed communication with the customer to further refine the customer's needs and expectations. These refinements are documented in the Product Plan. This process is followed when the customer desires a tangible product. The quality of the product and the effectiveness of the process is dependent upon the iteration between assembling, building, fielding the product and customer feedback. This iterative process is illustrated in Figure 3.0.

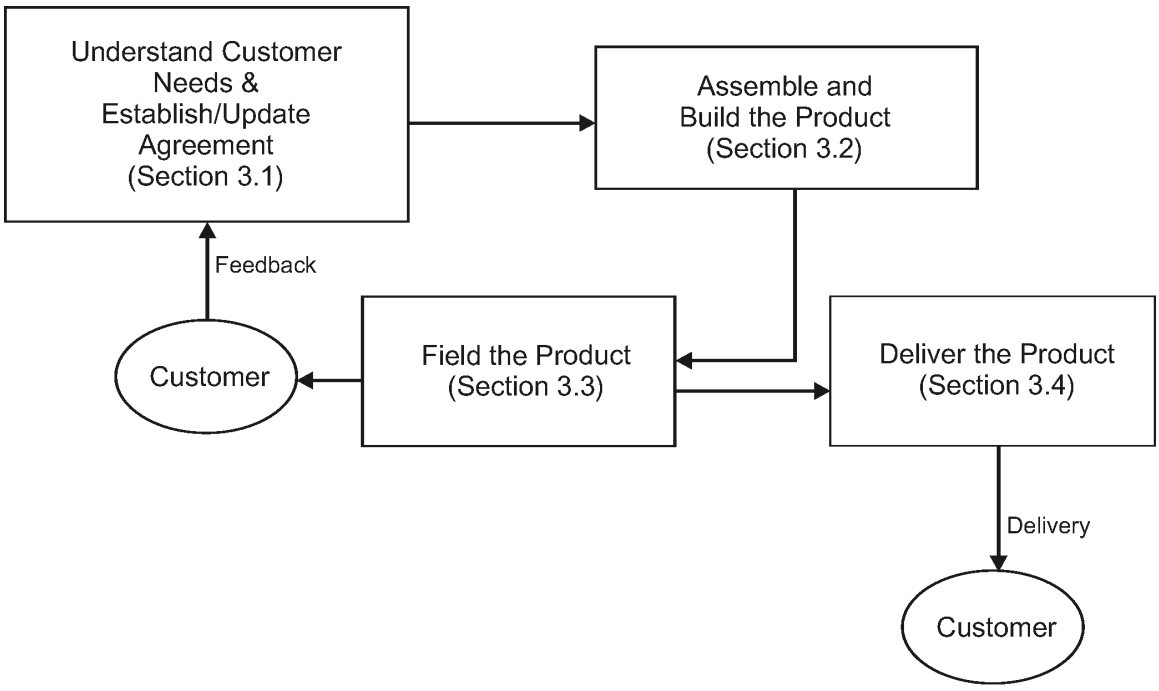


Figure 3.0 The Iterative Process for ISC Product Development

Roles and Responsibilities

Below are listed the roles and responsibilities associated with this process. Team and Team Lead roles have been expanded upon in Appendix C.

ISC Chief

- Designates the ISC Management Team Member responsible for the approval of any Product Plan covered by this handbook. Unless specified otherwise in the Product Plan, this will be the supervisor of the Team Lead.

ISC Management Team

- Ensure that approaches taken by the Team stay aligned with the ISC Strategic Implementation Plan
- Ensure that the Team obtains necessary resources in a timely and effective manner
- Reviews and approves the Team's Product Plan
- Effectively remove barriers which impede a Team's progress
- Ensure and defend the Team's empowerment rights throughout the process
- Document the process for reviewing and changing Product Plans (customer agreements)
- Facilitate support that the Team cannot provide themselves
- Ensure customer inputs for the Team Lead's performance plans and evaluations are made and maintained (appropriate supervisor)
- Ensure Team Lead's inputs for the Team performance plans and evaluations are made and maintained (appropriate supervisor)
- Provide training to Team members as requested by the Team lead
- Document any identified training needs of employees on Performance Plan
- Document any required OJT and "required" training per GPG 3410.2
- Allocate resources as requested by the Team and approved

Available Contracts Data Base Administrator

- Maintain a data base of current contracting mechanisms (hardware, software, manpower) that have demonstrated acceptable performance
- Details of the information and format for this database may be found in the Supplier Performance Records, GPG 5100.2

System Support Team (TBD)

- Maintain the organizational knowledge
- Provide support to Teams as requested

Team Lead

- Manage the entire customer order fulfillment process from receipt of the initial customer objectives to the final fielding of quality products to the customer

- Document each Team members roles and responsibilities for inclusion in the Product Plan
- Provide performance assessment on Team members as requested by the ISC Management Team
- Report appropriate information to customers and the designated ISC Management Team member in a timely and accessible manner
- Determine and document any training required for Team members and work with the ISC Management Team to ensure that training needs are met and that only qualified people work in producing the product
- Maintain a list of "required" training received by Team members
- Work with the customer and the ISC Management Team to resolve issues and conflicts that are beyond control of the Team
- Identify any internal or external consultants that may be needed
- Identify and request resources that are not directly under the Team's control
- Ensure that the Team maintains a customer focus throughout the process and aligns the Teams goals with the customer's objectives
- Ensure the Team works with the customer to define project guidelines and reflects these guidelines in the Product Plan
- Ensures the success of the Team in meeting customer requirements according to cost and schedule goals
- Provide leadership in developing a cohesive, focused, motivated Team
- Ensure Team personnel are implementing and following through on their responsibilities
- Maintain documentation of key issues and decisions, and, optionally, supporting rationale or information
- Produce and maintain a master list of documentation/information for the project and ensure it remains under Configuration Control. This is to include a:
  - ◊ Product Plan (see Appendix A)
  - ◊ List Of All Processes Used
  - ◊ List Of All Quality Record Types (in format listed in GPG 1440.7, see App. B)
- Identify a Quality Records Custodian whose name will be recorded in the Product Plan and who has responsibility for control of the quality records associated with the Product Plan
- Ensure Team personnel are implementing and following all of their responsibilities
- In addition to the work processes and processes identified above, documents that appear on the master list must be controlled
- Have a design plan and process management plan for your product development. Include these plans in the Product Development Plan.
  - ◊ Identify design verification and validation activities and assure that they are executed and documented
  - ◊ Establish a Team review plan and ensure that all planned reviews are conducted

- ◊ Document action items as Requests for Action (RFAs) and document responses to RFAs

- Ensure that the Team evaluates the need for statistical techniques required for developing or testing the product as well as the need for any statistical techniques required to analyze the product development process
  - ◊ Document any processes used to implement or control the application of any statistical techniques identified above
- Identify and use a corrective action process
  - ◊ The project corrective action process must address the following: customer complaints, actions resulting from audit findings, and major nonconformances (see GPG 1710.1)
  - ◊ Ensure that non-conformances meeting the criteria listed in GPG 1710.1 are documented in the Center on-line NCR/CA database. This shall occur after a version release of a system or subsystem to the customer or representative has occurred (accompanied by a release letter).
  - ◊ The process must be written and controlled. It must be referenced or detailed in the Product Plan.
- Identify and use a preventive action process
  - ◊ Maintain a Preventive Action List

- Define and use a Configuration Management process
  - ◊ The project must have an explicit, written Configuration Management process. It may be by reference, but it must be explicit and define what items will be controlled, who has authority to make changes, how the status of changes will be handled, and what configuration checking (audit) processes will be used.
- Have a process for reviewing and approving documents
  - ◊ All controlled documents and deliverables must be reviewed and approved. Projects must have a written process for completing this activity for documents controlled by the project.
  - ◊ All controlled documents and data must have evidence that they were reviewed and approved by authorized personnel. Further, changes to these must be reviewed and approved by the same functions/organizations that initially performed the activities.
- Have a written process for uniquely identifying and controlling all products
  - ◊ Develop a system to identify product and track status of work being performed on product and provide a method for s/w that tracks the status of tests planned/test results/and test status by unique s/w version number or build identification and date.
  - ◊ All products must have a unique product identification name or number so that erroneous products or versions are not used by project personnel in work performance
  - ◊ Ensure that tests and inspections to be conducted are documented in test plans
  - ◊ Ensure that status of tests and inspections are documented in test database

- Ensure that test results are documented and that testing does not proceed past a planned test/inspection point until non-conformances have been documented
- Every formal release shall be documented in a written release notice containing the version/release changes, including database changes, the requirements and the nonconformance information
- Have a process for controlling incoming products
  - ◊ Ensure that Receiving Inspection Instructions are prepared for incoming products where applicable and document on Work Order Authorization (WOA) (see GPG 4520.2) using GSFC Receiving Inspection & Test System (RITS)
  - ◊ Ensure that Receiving Inspection Instructions are executed and that any non-conformances are documented on WOA and on the appropriate non-conformance form (see GPG 5100.1)
- Provide input for evaluation for Supplier Performance Records (see GPG 5100.1)
- Ensure that test equipment and test software is working properly and maintain records of this verification
- Have a process for controlling and safeguarding any customer-supplied product
  - ◊ Inform the customer and obtain authorization if repair or rework is required of the customer supplied product
  - ◊ Document any damage or malfunction of customer supplied product and report to the customer for disposition of the product
- Ensure that any product requiring handling, storage or shipping is processed according to the GPG 6400.1. Retain shipping records on Form 20-4.

Team

- Defines their mission, vision and objectives based on their customer's objectives and ISC strategic implementation goals
- Identify customer expectations and develop metrics to ensure that those expectations are met quantitatively and qualitatively
- Establish effective communications mechanisms to facilitate the change process and to avoid misunderstandings
- Identify customer supplied resources and information that will be needed for the successful completion of the project
- Record effort and progress in the form of project metrics. Specific metrics are listed in Appendix E.
- Know the GSFC Quality Policy and how it affects products and processes, including Team efficiency
- Know where to find a master document list identifying the acceptable processes for performing the job
- Have an immediate access to all current process required for the job. Relevant process for the job must be written, reviewed, approved (signed by an authorized person), available (you must have access), current (up to date), and followed

- Know how processes used are improved or changed
- Discard or appropriately mark all outdated controlled documents
- Know where project schedules are maintained and what they are
- Know where Team quality records are maintained and be able to produce them
- Know how each unique version of a system or product is identified and controlled
- Know how you are qualified to do your work, how training is offered, and how work assignments are made
- Follow the processes that pertain to your job and maintain appropriate records

3.1 Understand Customer Needs and Establish Agreement

To deliver a quality product the Team must understand the needs and requirements of the customer. To do this, the Team communicates and builds consensus and agrees to the requirements. This agreement must be established, written and updated in the Product Plan. In ISO terminology, the Product Plan *IS THE QUALITY PLANNING DOCUMENT* for producing the product. The table of contents for a Product Plan and salient points are in Appendix A and include the customer agreement, the management approach, the technical approach, and product assurance. The length and level of detail of the Product Plan should be commensurate with the scope and complexity of the project. Updates to the Product Plan follow the same approval cycle as for the original agreement.

There must be a signed Customer Agreement, which should either specify the requirements directly or refer to where the requirements are documented. This agreement could be accomplished by having the customer sign the Product Plan. The Product Plan should also specify the elements and extent to which the customer's processes are to be used, especially in the areas such as reviews, non-conformance reporting, configuration management, inspection and testing, etc.

3.2 Assemble/Build Product

After producing the Product Plan, the Team begins the process of producing the product according to the Product Plan. The process begins with the Team working with the System Support Team to determine what organizational assets and information are available to be utilized on the Project. This might include technology assessments, Off-the-Shelf capabilities, lessons learned, etc. The process ends with the release of a product to the customer, whether it is a final delivery or an agreed-upon interim delivery with partial capabilities. The steps for assembling/building a product are illustrated in Figure 3.1.

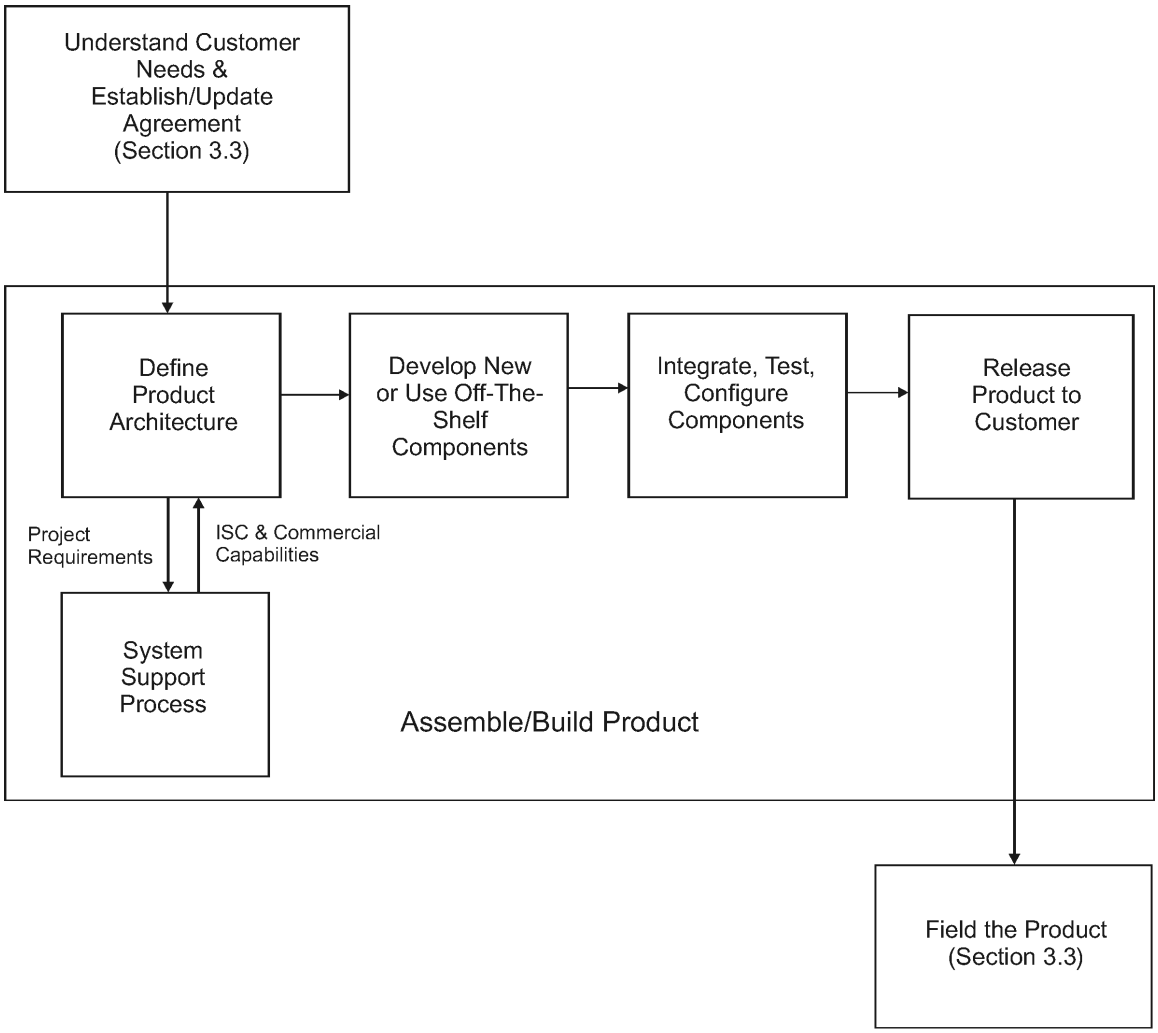


Figure 3.1 The Assemble/Build Process

3.3 Field Product

After building/assembling a release of the product the Team delivers the product according to the Product Plan. Test support is provided, as requested by customer, and might include such things as operational scenarios, special test cases, end-to-end testing, spacecraft integration and test, concurrent release testing, mission readiness testing. After fielding, customer feedback is evaluated. This includes both product and process assessments and metrics collection to be used in improving Team performance. Following this assessment, new agreements are reached as needed, and the process repeats again, beginning with the Understand Customer Needs and Establish Agreement step. The steps for fielding a product are illustrated in Figure 3.2.

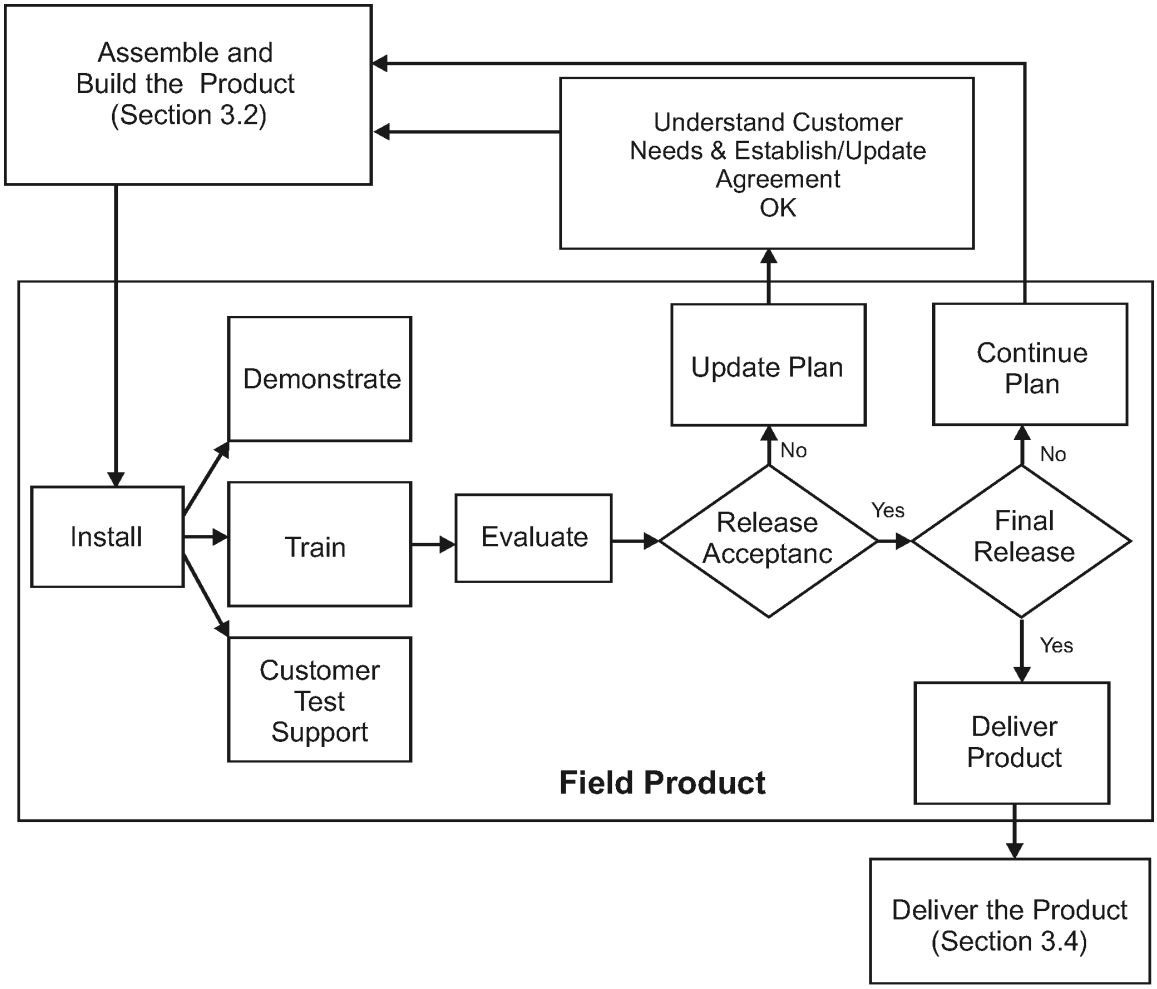


Figure 3.2 Fielding the Product

3.4 Deliver the Product

Once the customer has accepted the final product, any ancillary products specified in the Product Plan are to be delivered to the customer. This also triggers an orderly shut down of the project. Typical elements of the Deliver the Product Process include:

- Delivering final source code, users guide, test materials, and documentation, etc., to the customer
- Packaging appropriate information, quality records, and lessons learned, as available, and moving them to a central storage site
- Closing out contracts
- Closing out resources (money, facilities, and people)
- Transitioning the system to maintenance, as specified in the Product Plan
- Transferring licenses and agreements, as required
- Closing out Team Performance appraisal evaluations
- Celebrating Team success

The steps for delivering the product are illustrated in Figure 3.3.

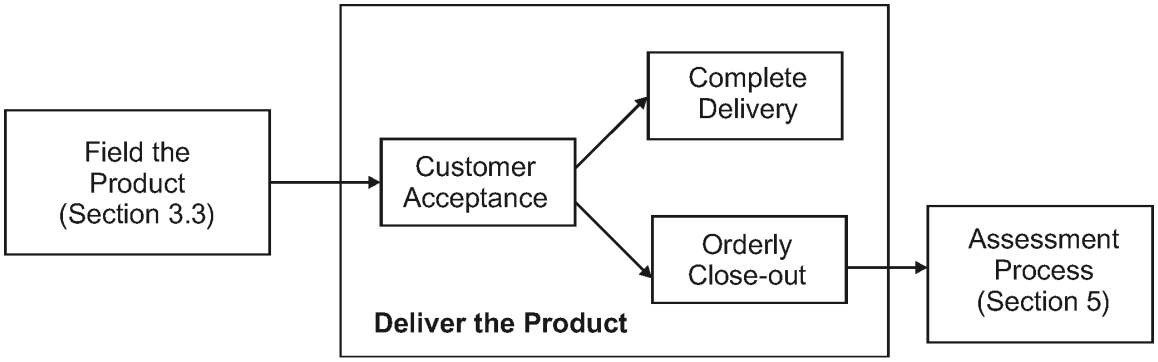


Figure 3.3 Deliver the Product Process

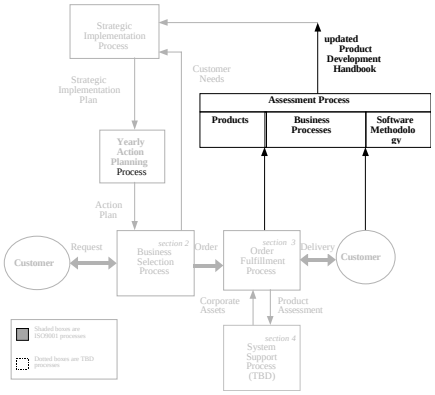
4.0 System Support Process (TBD)

The System Support Team maintains the organizational assets of ISC, and is responsible for ensuring that every Team is made aware of existing commercial and ISC capabilities and information that might be utilized by Teams in fulfilling customer orders. The role of the System Support Team is to:

- Research products and technologies that are available, and technology trends
- Assess products, technologies, and trends
- Develop and promote standards
- Maintain existing organizational capabilities
- Develop models, prototypes, and glueware (and document interoperability issues)
- Transfer technology to other projects and the commercial sector
- Maintain inventory and licenses for use by Projects
- Maintain repository of technology information and facilitate information exchange
- Provide help desk(s) for Order Fulfillment Process (Section 3)

THIS PROCESS IS TBD

5.0 Assessment Process



Assessments are done continuously throughout the lifecycle of the project, from initial request to closeout. Assessments are made of the Business Process, software process and products, and the product line. These assessments are also used to update the ISC Product Development Handbook as required, and to provide inputs to the Strategic Implementation Planning Process.

Roles and Responsibilities

Below are listed the roles and responsibilities associated with this process.

ISC Chief

- Establish a continuous improvement process for improving the Business Development Process and the Product Development Handbook

ISC Management Team

- Ensure the ISC Quality Manual (i.e., the Product Development Handbook) remains aligned with the GSFC Quality Manual
- Review GSFC Quality Management System for recommended improvements
- Ensure alignment of organization to the ISC Quality Manual
- Define responsibilities and authority for delivering quality products

5.1 Business Process Assessment

ISC Management Team is responsible for assembling a team consisting of selected ISC management and Team Leads, the ISC/ISO Representative, a Software Engineering Laboratory representative. This team:

- Collects feedback routinely from
  - ◊ Teams
  - ◊ Customers
  - ◊ ISC Management Team
  - ◊ ISC/ISO Representative
- Assesses the feedback
- Makes recommendations for improvement

- Solicits comments from all ISC personnel and supporting contractors
  - via the Web
  - via e-mail
- Finalizes recommendations to ISC Management Team
- Incorporates approved recommendations into Product Development Handbook and Strategic Implementation Process

5.2 Software Methodology Assessment

The Software Engineering Laboratory, using Team assessments and metrics collected during the project, provides recommendations for improvements to the software development process. The Software Methodology Process uses the following approach:

- Understand, characterize, and document ISC's software processes and products
- Identify candidate process changes, design studies based on ISC's business goals, and understand impacts and changes to the baselined process resulting from the proposed study
- Identify appropriate metrics required for s/w process improvement activities
- Collect, store, quality assure, summarize, and export the ISC's project data
- Analyze the project data to develop and maintain organizational models (e.g., cost estimation models, effort profiles, error profiles)
- Develop and update software engineering standards based on the experiences of the ISC Teams
- Package results and provide derived information in useful forms such as guidebooks, tools, and training courses
- Maintain the ISC's projects database, which contains historical data from the organization's various projects
- Maintain the ISC's library of experience packages, including guidebooks, standards, handbooks, and reports

5.3 Product Line Assessment

The ISC Management Team is responsible for assessing the product line:

- With respect to:
  - What customers want
  - The ISC strategic plan
  - The commercial market
- With respect to the minimum requirements of:
  - Customer satisfaction
  - Cost
  - Schedule
  - Burden of maintenance
  - Commercial product availability

5.4 Product Development Handbook Assessment

- Update handbook as required using ISC Configuration Management (GPG 1410.2) process

6.0 ISC Crosscutting Processes

This section provides information on three additional processes which are used and controlled at the ISC level (versus Team level). They are not part of the six basic ISC Business Processes, but are used in support of them in a crosscutting manner.

6.1 Configuration Control Process (Items include Quality Records, Documentation, and Data)

Roles and Responsibilities

ISC/ISO Representative

- Represent ISC at the Directorate level in all matters concerning ISO 9001 certification, implementation, and maintenance
- Direct all activities pertaining to ISO 9001 within ISC
- Overall responsibility for maintaining the ISC Product Development Handbook
- Review newly developed Team Processes specified in the Product Plan for ISO 9001 compliance
- Overall responsibility for adding/deleting/maintaining the ISC Library of Approved Team Processes

ISC Document Configuration Manager

- Maintains a list of ISC level quality records and configuration controlled items, date or identification number/letter, their locations and their owners
- Obtains approval for deletion of items from controlled list from the ISC Management Team

Process Description

- Quality record, documents, and data which are held and controlled at the ISC Center level are managed by the Document Configuration Manager
- When an individual desires to place a new document under CM that individual request permission via email from the ISC Chief
- Once approved, the ISC Management Team assigns an owner who is responsible for maintaining the history and current version of the item
- A list of all controlled items, their owners, their latest version date and their locations is maintained by the Document Configuration Manager
- The owner is responsible for ensuring that all information under his control is current, legible, readily retrievable and safe from damage/loss
- Deletion of items from the ISC level of control can be made by anyone through the owner to the Document Configuration Manager. The Document

Configuration Manager will then request permission from the ISC Management Team and will proceed accordingly.

- The Configuration Control Board for a document is determined by the ISC Management Team, and consists of those people identified on the document signature page and stated accordingly in the document under change control procedures
- Change control authority is determined by the ISC Management Team and is indicated by those people/positions on the signature page of each document
- For items under configuration control requiring updates, the following change control process will be used:
  - ◊ Changes to any item may be submitted by anyone to the owner of the configured item. This shall include an assessment of the cost and schedule impact, and changes required to other configuration controlled items.
  - ◊ The owner shall log the change request and prepare the appropriate document updates
  - ◊ The owner will communicate with other owners affected by the item and any other personnel deemed appropriate in order to negotiate the acceptability of the change
  - ◊ The owner will document the negotiated changes required by any other owners and distribute them to the owners and Document Configuration Manager
  - ◊ Individual owners affected by this change are responsible for updating their respective configuration controlled items to reflect negotiated changes
  - ◊ The owner shall make the appropriate changes in the configuration controlled copy of the document and update the document date
  - ◊ Notification of items that have been updated are to be sent via email to the Document Configuration Manager and to all affected personnel by each owner. The Document Configuration Manager shall retain the email notifications of the document updates.

6.2 Process for Adding, Deleting or Modifying Approved Team Processes in the Library for Use in Product Plans

The Library of Approved Team Processes is maintained on the web at http://isc.gsfc.nasa.gov/Iso9k/ISO9001.htm by the ISC/ISO representative, and is under ISC configuration control.

Roles and Responsibilities

ISC/ISO Representative

- Review newly developed Team Processes specified in the Product Plan
- Overall responsibility for maintaining the ISC Library of Approved Team Processes

Library Modification

- Anyone can make a recommendation for adding, deleting or modifying a reference
- The recommendation should be written up and should include the process to be added, deleted or modified, the name of the process for which it is an alternate (relative to the Product Plan Table of Contents), and a short description of the merits of the approach
- The recommendation should be submitted to the ISC/ISO Representative for an assessment of compliance with ISO 9001
- Once approved, the ISC/ISO Representative is responsible for ensuring that the new process is included in the reference library for approved use
- The ISC/ISO Representative shall notify the ISC Document Configuration Manager to update the documentation in the ISC Configuration Controlled Items database
- The ISC/ISO Representative shall notify all of Code 580 and its support contractors of the update via e-mail

Appendix A: Product Plan Instructions

Product Plan—A description of the work to be performed and the resources needed to accomplish the goals and objectives established in the customer agreement. In ISO terminology, the Product Plan is the *QUALITY PLANNING DOCUMENT* for producing the product. The Product plan includes the *design planning information* and the *process management information*.

Figure A-1 is the table of contents to be followed by all Teams in generating their Product Plan. All components shall be addressed, but the level of detail is left to the Team based on product complexity and customer needs/expectations.

ISO 9001 standards require certain quality control processes to be documented. Those processes that are required and the criteria that they must meet are described in Appendix D. Samples of these required processes that meet these criteria are in the Library of Approved Team Processes (see Appendix G). Each team in their product plan may either refer to one or more specific approved processes, or develop and document their own processes. Any new processes must meet the criteria specified in Appendix D and be approved by the ISC ISO representative. The effective date of the Product Development Handbook being used is to be placed directly under the Product Plan "Table of Contents" label on the "Table of Contents" page and should be labeled as "Version Date xx/xx/xx". This effectively freezes the version of the Product Plan Table of Contents for the duration of the Product Plan.

The following disclaimer should be placed in the footnote section of every page:

> "Printed copies of this document are for **REFERENCE PURPOSES ONLY**! The only controlled copy of this document is located on-line at http://xxxxxxxx."

Optionally for Product Plans originally signed prior to ***8/1/99***, this disclaimer may appear directly after the signature page:

> "References to documents and data (hard copy or electronic) in the Product Plan ***not*** directly under the Team's control shall contain the version identification in the Product Plan."

The Work Order Authorization (WOA) equivalent for software development referred to in the GSFC QMS is defined by the contents of Sections 3.1 and 4.2.1 of the ISC Product Plan, including all associated documentation and references.

Section 1 of the Product Plan (Customer Agreement) may be under either Project or ISC control. It follows the configuration management process outlined in Section 1.15. A customer signature for the Section 1 of the Product Plan is highly recommended (see Figure A-2).

The remaining sections of the Product Plan are under ISC Configuration Management and follow the configuration management process defined in Section 4.2.1. At a minimum, these portions of the Product Plan require a Team Lead signature and an appropriate ISC Management Team signature for approval (see Figure A-3).

The remainder of this appendix lists the product plan subsections with a description of the contents following each subsection heading. Quality records and controlled documents

are identified in tables in the appropriate subsections. Tables labeled as objective evidence indicate other records that should be maintained by the Team, but are not included on either the quality records list or the controlled documents list.

Certain subsections may be included by reference if documented elsewhere. These subsections are identified with an asterisk (*). It is recommended that subsections containing frequently changing information be included by reference.

Table of Contents for Product Plan

Table of Contents—Product Development Handbook -Version Date: xx/xx/xx

Document Change History—Include version identifier and description of change

Customer Agreement Signature Page

Product Development Signature Page

1. Customer Agreement
2. Management Approach
3. Technical Approach
4. Product Assurance
5. Plan Update History

Appendix A—Acronyms and Abbreviations

Appendix B—References

Figure 1. Template for Table of Contents

NOTE: See following pages for detailed information on contents of each section.

Customer Agreement

for the

(project name)

(system type[1]) Development

Release Date

Month/Year

Prepared by: _____

XXXXXXX

Team Lead

Approved by: _____

XXXXXXX

Customer/Designee

Approved by: _____

XXXXXXX

Information Systems Center Management Representative [2]

The Team Lead, the Customer/Designee, and the Information Systems center Management Representative constitute the Configuration Control Board for the Customer Agreement portion (Section 1) of this document.

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FIGURE 2. Template for Customer Agreement

Notes: (1) System types—This would be ground data system, flight software, command and data handling system, etc.

(2) Information systems Center Management Representative—Title listed here should be the specific title of the ISC manager responsible for the development, for example, "Code 5xx Branch Head"

Product Development

for the

(project name)

(system type[1]) Development

Release Date

Month/Year

Prepared by: _____

XXXXXXX

Team Lead

Approved by: _____

XXXXXXX

Information Systems Center Management Representative [2]

The Team Lead and the Information Systems center Management Representative constitute the Configuration Control Board for this document, with the exclusion of the Customer Agreement (section 1).

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FIGURE 3. Template for Product Development

Notes: (1) System for types—This would be ground data system, flight software, command and data Handling system, etc.

(2) Information Systems Center Management Representative—Title listed here should be the specific title of the ISC manager responsible for the development, for example, "Code 5xx Branch Head"

1.0 Customer Agreement (GPG 1310.1)

1.1 Background

A brief (maximum of one paragraph) description of what larger effort/activity this Team is supporting and how this product fits into the larger picture.

1.2 Team Charter

A brief one-paragraph description of what this Team is being asked to accomplish, including any time constraints or interface boundaries within which this Team is expected to operate.

1.3 Customer(s) Identification

The customer is usually a Flight Project or the person who pays the bill. Otherwise, it should be the person who will define the requirements and accept the products.

1.4 Customer Goals and Objectives

Any special things that the customer wants to accomplish (e.g., rapid turn around, new architecture, special COTS requirements, special experiments, etc.) through this Team's activities.

1.5 Requirements*

This section should list or reference (preferred) any functional/operational requirements as specified by the customer. Include any specific standards to be met and list the interface control documents needed. References must include revision date/number for documents not under direct control of Team Lead. Do not include technical interface documents or databases here. Reference them in Section 2.4

Controlled Document	Comment	Record Held By
Functional Requirements	Signed and dated by Customer	Project or Team Lead

1.6 Deliverables

List products to be delivered for each phase, including software, hardware, licenses, documentation, etc., as directed by customer.

1.7 Schedules*

List *customer—specified* schedule requirements, including such items as documentation, releases and reviews.

1.8 Necessary Customer Training

Specify who is to be trained how many are to be trained, location and nature of training.

1.9 Medium/Method for Product Delivery (GPG 6400.1)

List any required delivery medium and method of delivery for all products listed in Section 1.6

Quality Record	Comment	Record Held By
Shipping Records		Team Lead

1.10 Product Destination

List product delivery destination for all products listed in Section 1.6.

1.11 Post Delivery

Describe who will do maintenance after and how it will be requested/approved. Describe process that will be used for maintenance activities for all products in Section 1.6

1.12 Customer-supplied elements, both technical, and resources (schedule, medium, and interfaces)

List any technical elements supplied by the customer that will be used in the production, testing or packaging/delivery of the product. Do not include funding. Include delivery schedule and medium of supplied items.

1.13 Customer involvement (roles, responsibilities, authority, accountability)

Provide details on the extent of direct customer involvement with the Team (Attends Team meetings? Reviews results? Provides direction? Etc.)

1.14 Acceptance Criteria*

Describe the customer's criteria for determining when the product is completed, (i.e., when will the customer accept the product?) This is usually demonstrated by having a satisfactorily completed test matrix/set of test plans. Customer verbal acceptance is not sufficient.

1.15 Customer Agreement Review and Update Process

Describe the process used to evaluate and approve changes to the customer agreement. Be sure to note that the Team will be evaluating the changes to assure that they have the capability of providing the requested changes. Approval authorities (those listed on the signature page) must be listed specifically by name and title. It must be stated that they consist of the Change Control Board (CCB) or the CCB process/membership must be described or referenced. The original approval authority must approve changes.

2.0 Design Planning and Interface Management (GPG 8700.1)

Controlled Document	Comment	Record Held By
Product Plan	Signed and dated by the CCB which is listed in Plan—usually Team Lead, Branch Head, Customer.	Team Lead
Design Planning Materials • Review Plan • Development Phases	May be in product plan.	Team Lead

Objective Evidence	Comment	Record Held By
Design Planning Materials • Team Work Assignments • Team Organization • Schedules • Budgets	May be included in product plan by reference.	Team Lead

2.1 General development approach

Describe in a sentence or two the general philosophy that will be used to build the product, discussing such aspects as use of commercial-off-the-shelf (COTS), contractor involvement, schedule constraint, use of a particular development methodology or new technology, etc.

2.2 Resources needed (budget, people/skills, and facilities)*

Indicate where the *official* budget is kept. In most cases, the budget will probably reside with the Project. Budget information should be kept by fiscal year, and include both civil servant manpower and any contractor support. Address any specific facilities or any facility modifications required for use in development or testing and their expected required dates.

2.3 Team Organization

2.3.1 Team Organization

Include an explanation or diagram illustrating the organization of the Team personnel and its activities. Note: Any Team organization chart not included in the product plan must be signed and dated. Include the relationship of the Team Lead to the higher level Project organization, if applicable.

2.3.2 Roles, Responsibilities, Authority, Accountability of Team Members*

Describe the method used to assign work to Team members and document the work assignments. Assignments can be made by subsystem (e.g. Command & Data Handling, Planning & Scheduling) or by work function (e.g. testing)

2.3.3 Decision making and conflict resolution process

Describe the method used to resolve conflicts within the Team. If group decisions are used, identify the tiebreaker or ultimate decision authority.

2.4 Team interfaces to other teams, organizations, or groups

Describe any interfaces to other organizations, teams, or groups necessary in developing the product, and a *brief* description of the purpose of each interface. This may include things such as the interface of the ISC flight software team to the flight hardware group for working compatibility issues, or the interface of the Ground Data System to the Flight Operations Team for acceptance of the system.

2.5 Procurement* (GPG 5100.1)

Describe all hardware and software purchase requirements in detail (i.e., What are you going to buy?) Include any purchases necessary for facility modification. If you are using contractor support, list the contractor name and contract number. If special or usual contracting arrangements are required, describe them. Reference the procurement process used to make purchases. Be sure to use RITS for all items within scope.

Quality Record	Comment	Record Held By
Purchase Requests		Team Lead or Team procurement person

2.6 Team training plan* (GPG 3410.2)

Identify any QMS Required Task Specific training need for each Team member. When training is complete, document it by keeping a list of name, course, and date completed. (QMS Required Task Specific training is defined as training that must be taken to acquire new skills or enhance current skills required to perform tasks of that position that affect quality. Examples are Hand Soldering Certification, Electrostatic Discharge Awareness Training, Laser Safety, Cleanroom Procedures, Range or Launch Safety Training, Flight Operations Team Certification, or any required Project-specific training)

Quality Record	Comment	Record Held By
Records of Required Training Needed		Team Lead or Project
Records of Required Training Completed		Team Lead or Project

2.7 Risk mitigation

Describe any areas where there is a special risk to the delivery of the product (if any) and describe how it will be addressed. If there is none, state that.

2.8 Security

Describe the plans for addressing security considerations, both physically for the facilities involved and electronically for any computer systems being used either for development and testing or as a part of the final product.

2.9 Detailed Schedules*

This should be the detailed schedule used to manage the Team's activities. It should contain the Team life cycle schedule including facility preparations, procurements, system development by phase and release, product delivery, and maintenance (if applicable). Make sure to include review dates, documentation, interface control document's (ICD's) delivery dates; test dates, software release dates, procurements, and external deliveries to the customer. It should include and be consistent with customer schedules defined in Section 1.7.

2.10 Technology and commercialization plan

This should describe any technology advancement, technology infusion, and commercialization initiatives that are drivers for any aspect of this product plan. Especially describe any initiative for which the corresponding product plan activities would not be performed if the technology or commercialization initiative was not considered. If there is none, state that.

3.0 Technical Approach

3.1 Design Development (GPG 8700.2)

3.1.1 Product Requirements*

Describe (or reference) the derived requirements/specifications developed by the Team and approved by the Customer. These should include assumptions, interfaces, and performance information. Ensure that requirements are testable. These requirements can be the customer's original requirements (if so, just reference Section 2.3) or can be those derived by the Team itself.

Controlled Document	Comment	Record Held By
Derived Requirements	Signed and dated by Customer and Team Lead	Project or Team Lead
Interface Control Documents	Signed and dated by Representatives of Interfacing Organizations	Project or Team Lead

3.1.2 Product Design*

Describe the design of the product that the Team is planning to produce. Describe how changes in design are updated and traced to changes in the requirements.

Quality Record	Comment	Record Held By
Completed Design Documentation	May include: • High-level architecture description • Design Review Materials • Design Documents	Team Lead

3.1.3 Development Strategy

Describe at a HIGH LEVEL the software components you will build, the commercial off-the-shelf/Government off-the-shelf (COTS/GOTS) or customer supplied items you will use, the prototyping plans, and the integration requirements.

3.1.3.1 Buy Approach* (GPG 5100.1)

Describe any special purchasing strategies for items specified in Section 2.5.

3.1.3.2 Build Approach*

Include the development phases, the sequence of builds, the high level inputs and outputs per build, vendor/customer/prototype elements to be integrated, and the high level functional requirements satisfied in each build.

Quality Record	Comment	Record Held By
Completed Build Plan	Part of software work order authorization (WOA)	Team Lead

3.1.3.3 Prototyping Approach*

Describe any prototyping activities required to develop the product and the purpose for the prototype (i.e., what specific questions are to be answered by the prototype?)

3.1.3.4 Customer Supplied Products Approach

List and briefly describe any software that will be received from the customer for integration into the final product, and any assumptions concerning them.

3.1.4 Product Testing

3.1.4.1 Product inspection and test * (GPG 5330.1)

Describe the testing approach from unit through product delivery (including in-process and final inspection). Reference your test plans and discuss your testing approach for unit, build, and acceptance testing, test team (developers, independent, customer), test data (simulator, supplied data, flight hardware, real data), and any acceptance criteria (particularly any from the customer for final acceptance—Section 2.11). Describe how changes in design are mapped to changes in test plans.

Controlled Document	Comment	Record Held By
Documentation of Verification Activities	Include one or more: • Unit Test Plans • Code Reading Checklist • Design Baseline • Integration Test Plans • Build Test Plans	Team Lead

Quality Record	Comment	Record Held By
Documentation of Verification Activities	Include one or more: • Unit Test Results • Code Reading Signoffs • Design Walkthrough Documentation (including issues and resolutions) • Integration Test Results • Build Test Results	Team Lead

Controlled Document	Comment	Record Held By
Documentation of (End-to-End) System Validation Activities	**Include one or more:** • High Level Description of Test To Be Run (Can be in Test Procedures) • Test Validation Matrices • Detailed Description of Tests with Inputs, Expected Outputs, and Step by Step Procedures for Running the Tests • Acceptance Criteria	**Team Lead**

Quality Record	Comment	Record Held By
Documentation of (End-to-End) System Validation Activities	Include one or more: • Validation Matrices • Validation Test Results	Team Lead

3.1.4.2 Incoming inspection and test (GPG 4520.2)

For purchased items, including hardware, document the Receiving Inspection Instructions to describe special receiving instructions and tests if other than kind, count and condition. Be sure that all in-scope products received after May 1, 1999, are identified and entered into the RITS system.

Quality Record	Comment	Record Held By
Receiving Inspection Instruction (RITS entry)	RITS entry made by Team Lead or Team purchase person	Team Lead or Team purchase person
RITS Work Order Authorization (WOA)		Team Lead

Incoming Inspection Nonconformance Report	See GPG 5340.2	Center Nonconformance Reporting/Corrective Action (NCR/CA) System

3.1.4.3 Statistical Techniques* (GPG 8070.2)

Unless the Team determines a need for statistical testing of the product or other statistical methods, include the following paragraph in this section of your Product Plan.

"The Team has evaluated the need for statistical testing of the products developed under this Product Plan and has determined that statistical techniques are not required."

Examples of statistical techniques being used are (1) techniques to obtain reliability of hardware systems and (2) comparisons of output results after a platform language conversion. If statistical techniques are being used, then the procedure for their use must be documented.

3.1.5 Development Status*

3.1.5.1 Design/Implementation Status

Describe the method(s) that will be used to track the status through this phase of the product.

Objective Evidence	Comment	Record Held By
Status Information	May include: • Schedule Charts with Status Indicated • Module-by-Module Checklist • Configuration Management Records • Documentation of Weekly Status Meetings	Team Lead or designee

3.1.5.2 Testing Status

Describe the method used to track testing status of the product throughout its life cycle.

Objective Evidence	Comment	Record Held By
Test Status Information	May include: • Test Status Chart • Weekly Test Meeting Status • Signoffs of Completed Tests in Test Plan or Procedures	Team Lead or designee

3.1.6 Development Environment

Describe the development and test hardware and locations, and all Team development standards, as appropriate.

3.1.7 Technical Review Program (GPG 8700.4)

Describe the types of reviews you plan to have and the membership of the review boards. This should include a discussion of any code or design walkthroughs you plan to use as verification of the design. You must have at least a requirements review, a design review, and a product acceptance review with the customer where requests for action (RFAs) and responses are kept. Peer reviews as defined by GPG8700.4 may include team reviews where one team member reviews another team member's work and should be included on the Team review plan. Project related reviews and other higher level reviews may be supported as requested and they should be listed in the Project Plan.

Quality Record	Comment	Record Held By
• Requests for Action (RFAs) and Responses from Review Meetings • Review Meeting Notes with Action Item List and Resolutions	Include One	Team Lead or CCB Chair

3.2 Process for handling, storage, packing, marking, preservation and transportation (GPG 6400.1)

List the medium for the various products to be delivered if different from Section 1.6 and state how they will be delivered to the customer. Describe any plans (such as back-ups) to prevent loss or damage to the product in all phases of development, including software, documentation and hardware.

3.3 Servicing

Describe the process for post delivery product maintenance (i.e., How do you plan to meet the requirements specified in Section 2.8?) Address responsibility for the maintenance, request process, process for doing work, and product redelivery for custom, government off-the-shelf (GOTS) and COTS software and hardware.

Quality Record	Comment	Record Held By
Maintenance requests		Team Lead
Redelivery letters		Team Lead

4.0 Product Assurance

4.1 Product Quality Assurance

4.1.1 Control of Nonconforming Products and Corrective Action* (GPG 5340.2/ GPG 1710.1)

Describe the process for recording and correcting problems in a "minor" Nonconformance Reporting (NCR)/Corrective Action system. Include a description of the process used to evaluate the cause of the problem and to assess whether any changes need to be implemented to prevent future recurrences. The minor NCR system should include the version or release number where the problem was found and ideally, the version number that includes the corrections. Nonconforming products are both identified by their associated NCRs and the associated release numbers. Any products released to the customer will include a ***release letter*** listing the release number, the included capabilities of the release, and a description of any remaining nonconformance in the release. Products with remaining nonconformance may only be released to the customer with proper approval. (See Library of Approved Team Processes or Criteria 7 in Appendix D.) The Center nonconformance reporting/corrective action (NCR/CA) system shall be used if no minor nonconformance system exists or if the nonconformance meets the Center wide criteria listed in the GPG.)

Quality Record	Comment	Record Held By
Nonconformance records from minor NCR system		Team Lead or Nonconformance Lead
Nonconformance records from Center NCR system		Center NCR system
Corrective Action Plans	May be in NCR system	Team Lead or Nonconformance Lead
Product Release Letters		Team Lead

4.2 Configuration Management (GPG 8700.2)

4.2.1 Control of Team software, hardware, documentation, and data*

Describe how your Team does configuration management for your software, hardware and documentation and who has the change authority for each. If you use the Project's process for any of those, reference where their procedures can be found. Describe the signature and change authority for the development sections of the Product plan.

Describe the method used to uniquely identify versions of the software and the elements from which it is built. The use of a commercial configuration management tool is strongly recommended for environments where one is available. If on-line copies of documentation or software are considered the controlled copy, then the approval authority must control on-line access. A list of documents and data under configuration management by the team is to be referenced in the Product Plan in this section. The list is to include the document or database name, the date or version identification of the current version, the location of the documents or database, and the person responsible for the item. Note: Any data bases or web sites containing controlled information directly under the Team's control shall contain a header identifying what is being viewed, as well as the date of the last change and person responsible for its control. (See Library of Approved Team Processes or Criteria 2B and 2B in Appendix D.)

Quality Record	Comment	Record Held By
Software CM records		Team Lead (or Configuration Manager)
List of items under configuration management		Team Lead (or Configuration Manager)
Copy of signature page of configuration management item		Team Lead (or Configuration Manager)
Records of CCB approval		Team Lead (or Configuration Manager)

4.2.2 Control of test software and hardware (GPG 8730.1)

Describe anything used to test the product, which may be both hardware and software. Describe how this software will be validated (i.e., how do you convince yourself that the simulator is working properly?) If the software used for testing is not the final validation, but is only used as part of a self-check, where neither the test software or the product being tested is considered correct until the final results are correct, then describe that test scenario. Describe or reference the configuration management process used to ensure the appropriate version of the simulator is used. See Library of Approved Team Processes or Criteria 4 in Appendix D. Also, discuss any inspection, measuring and test equipment (IMTE) being used and any calibration requirements.

Controlled Document	Comment	Record Held By
Documentation of Test Software Verification Activities	Include one or more: • Test Plans • Acceptance Criteria	Team Lead

Quality Record	Comment	Record Held By
Calibration records and calibration due dates for IMTE Team is using		Team Lead
Test software test results		Team Lead
Records of Verification from Contractor		Team Lead

4.2.3 Quality Records* (GPG 1440.7)

Identify the Team's Quality Records Coordinator (person who keeps the Quality Records List) and the location of the Quality Records List. Describe the process by which an element is added to the Quality Record List by the Coordinator and filed with the Custodian.

Controlled Document	Comment	Record Held By
Quality Records List		Team Lead

4.2.4 Control of customer supplied products* (GPG 5900.1)

Describe the method that will be used to check out or test the software or hardware supplied to you by the customer for inclusion into the product or for testing or packaging of the product. If a customer provides items for use by the Team in the development/testing of the product, describe the process used to report any problems with the item(s) back to the customer. Describe the configuration management process for customer supplied elements listed in Section 1.12 for changes initiated by the Team or by the customer. Include any other processes used to safeguard customer supplied products. (See Library of Approved Team Processes or Criteria 3 in Appendix D.) This section should address simulators, test data, software algorithms, software and/or hardware received from the customer.

Quality Record	Comment	Record Held By
Problem Reports on Customer-Supplied Products		Team Lead

4.3 Process and product metric analysis*

It is a requirement to collect the metrics described in Appendix E, at a minimum. Additionally, product metrics, Team process metrics, and ISC metrics may be collected. Describe how you will use these metrics for process improvement (see Library of Approved Team Processes or Criteria 10 in Appendix D).

Quality Record	Comment	Record Held By
Data and Completed Forms Representing the Required Metrics		Team Lead

5.0 Product Development Journals

5.1 Team Lessons Learned

Maintain a log of lessons learned throughout the life cycle of the team activities. The final lessons learned report is intended to be a brief (about one-half page) summary of the key recommendations for changes or inclusion in future similar projects.

Objective Evidence	Comment	Record Held By
Lessons Learned Log or document		Team Lead

5.2 Key Issues, Decisions, and Rationale

Maintain a log of key issues, decisions, and rationale through the life cycle of the Team.

Objective Evidence	Comment	Record Held By
Log of Key Issues, Decisions, rationale		Team Lead

*Items may be included by reference

Appendix A: Acronyms and Abbreviations

Appendix B: References

Include a list of any references used in the Product Plan.

Appendix B: List of Quality Record Types

This appendix contains examples of typical ISC ("Center") level and Team level Quality Record types which must be maintained for ISO 9001 compliance.

General information on quality records:

- Quality records demonstrate implementation or completion of the activity or function or the actual as-built or as-tested configuration. They are *not* revised once completed.
- Each Branch and each Product Team must have a Quality Records List and a Quality Records Coordinator. For the Quality Records List use the template in GSFC form 2266 which can be found on the GSFC ISO 9001 web site.
- Unless otherwise documented in a QMS document, the Quality Records Coordinator is the Product Team lead for Teams and the Branch Head for Branches.
- Product Team Quality Records List shall only contain those quality records controlled by the Team (Other quality records associated with the Team, but controlled by another group, shall be listed on the other group's quality record list.
- In preparation for an ISO 9001 audit, copies of these types of records would need to be provided to the Lead Auditor for inspection, upon request within one hour.
- All Team members must know the location of these Quality Records.
- Quality records for internal (to ISC) teams shall be maintained in the appropriate Branch for one year following delivery of the product. For the flight projects, the quality records transition to the flight project at the time of the termination of the Team activities.
- Those quality records listed under the Team need not be separate documents, but could be combined into the number of documents that the Team feels is appropriate.

Examples of ISC Quality Management System Documents

- ISC Product Development Handbook

Examples of Typical ISC Quality Record Types

- Team Lessons Learned
- ISC Metrics Collected
- Employee Training Records (formal, other) (see GPG 3410.2- Official records should be in OHR)
- Required On the Job Training Records (Form GSFC 17-112, see GPG 3410.2)

Team Quality Record Types are described in Appendix A.

Appendix C: ISC Roles and Responsibilities

Below are the aggregate list of the roles and responsibilities of ISC members in the total Business Development Process components defined throughout the Product Development Handbook. It is collected here for convenience. Team and Team Lead roles have been elaborated on from an ISO 9001 perspective.

Roles and Responsibilities of the Team Lead

From Section 2:

- Meet with the customer to understand and document the product requested
- Present to the ISC Management a estimate of the staffing and skill levels, and approximate time commitments required to meet the customer's request
- Assess the skills and expertise needed. Work with the ISC Management Team to select an appropriate qualified Team to ensure that the individuals are qualified to perform their assigned responsibilities.
- Maintain a list of any "required" training needed and received by Team members
- Assign work to Team members

From Section 3:

- Manage the entire customer order fulfillment process from receipt of the initial customer order to the final fielding of quality products to the customer
- Document each Team member's roles and responsibilities for inclusion in the Product Plan.
- Provide performance assessment on Team member as requested by the ISC Management Team
- Report appropriate information to customers, and the designated ISC Management Team member in a timely and accessible manner
- Determine and document any training required for Team members and work with the ISC Management Team to ensure that training needs are met and that only qualified people work in producing the product
- Maintain a list of "required" training received by Team members
- Work with the customer and the ISC Management Team to resolve issues and conflicts that are beyond control of the Team
- Identify any internal or external consultants that may be needed
- Identify and request resources that are not directly under the Team's control
- Ensure that the Team maintains a customer focus throughout the process and aligns the Teams goals with the customer's objectives
- Ensure the Team works with the customer to define project guidelines and reflects these guidelines in the Product Plan

- Ensures the success of the Team in meeting customer requirements according to cost and schedule goals
- Provide leadership in developing a cohesive, focused, motivated Team
- Ensure Team personnel are implementing and following through on their responsibilities
- Maintain documentation of key issues and decisions, and, optionally, supporting rationale or information

With respect to ISO 9001 compliance, the Team Lead specifically needs to:

- Produce and maintain a master list of documentation/information for the project and ensure that it remains under configuration control. This is to include a:
  - ◊ **Product Plan** (see Appendix A)
  - ◊ **List of all processes used**
  - ◊ **List of all quality records** (on Form in GPG 1440.7) (see Appendix B)
- Identify a Quality Records Custodian whose name will be recorded in the Product Plan and who has responsibility for control of the quality records associated with the Product Plan
- Ensure Team personnel are implementing and following all of their responsibilities
  - ◊ In addition to the work processes and processes identified above, documents that appear on the master list must be controlled
- Have a design plan and process management plan for your product development. Include these plans in the Product Development Plan.
  - ◊ Identify design verification and validation activities and assure that they are executed and documented
  - ◊ Establish a Team review plan and ensure that all planned reviews are conducted.
  - ◊ Document action items as RFAs and document responses of RFAs
- Ensure that the Team evaluates the need for statistical techniques required for developing or testing the product as well as the need for any statistical techniques required to analyze the product development process
  - ◊ Document any processes used to implement or control the application of any statistical techniques identified above
- Identify and use a corrective action process
  - ◊ The project corrective action process must address the following: customer complaints, actions resulting from audit findings, and major nonconformances (see GPG 1710.1)
  - ◊ Ensure that non-conformances meeting the criteria listed in GPG 1710.1 are documented in the Center on-line NCR/CA database. This shall occur after a version release of a system or subsystem to the customer or representative has occurred (accompanied by a release letter)
  - ◊ The process must be written and controlled. It must be referenced or detailed in the Product Plan.
- Identify and use a preventive action process

- ◊ Maintain a Preventive Action Action List

- Define and use a Configuration Management process
  - ◊ The project must have an explicit, written Configuration Management process. It may be by reference, but it must be explicit and define what items will be controlled, who has authority to make changes, how the status of changes will be handled, and what configuration checking (audit) processes will be used.
- Have a process for reviewing and approving documents
  - ◊ All controlled documents and deliverables must be reviewed and approved. Projects must have a written process for completing this activity for documents controlled by the project.
  - ◊ All controlled documents and data must have evidence that they were reviewed and approved by authorized personnel. Further, changes to these must be reviewed and approved by the same functions/organizations that initially performed the activities.
- Have a written process for uniquely identifying and controlling all products
  - ◊ Provide a system to identify the product and track status of work being performed on product and provide a method for software that tracks the status of tests planned/ test results/ and test status by unique software version number or build identification and date
  - ◊ All products must have a unique product identification name or number so that erroneous products or versions are not used by project personnel in work performance
  - ◊ Ensure that status of tests and inspection s are documented a form which tracks the status of planned tests/ test results and test status by unique software version or build identification and date
  - ◊ Ensure that test results are documented and that testing does not proceed past a planned test/inspection point until non-conformances have been documented
- Every formal release shall be documented in a written release notice containing the version/release changes, including database changes, the requirements and the nonconformance information (see GPG 5330.1 Section 2.1.5)
- Have a process for controlling incoming products
  - ◊ Ensure that Receiving Inspection Instructions are prepared for incoming products where applicable and document on WOA (see GPG 4520.2) using GSFC RITS
  - ◊ Ensure that Receiving Inspection Instructions are executed and that any non-conformances are documented on WOA and on the appropriate non-conformance form (see GPG 5100.1)
- Provide input for evaluation for Supplier Performance Records (see GPG 5100.1)
- Ensure that test equipment and test software is working properly and maintain records of this verification

- Have a process for controlling and safe-guarding any customer-supplied product
  - ◊ Inform the customer and obtain authorization if repair or rework is required of the customer supplied product
  - ◊ Document any damage or malfunction of customer supplied product and report to the customer for disposition of the product
- Ensure that any products requiring handling, storage or shipping are processed according to the GPG 6400.1. Retain shipping records on Form 20-4.

Roles and Responsibilities of the Team

- Defines their mission, vision, and objectives based on their customer's objectives and ISC strategic implementation goals
- Identify customer expectations and develop metrics to ensure that those expectations are met quantitatively and qualitatively
- Establish effective communications mechanisms to facilitate the change process and to avoid misunderstandings
- Identify customer supplied resources and information that will be needed for the successful completion of the project
- Record effort and progress in the form of project metrics. Specific metrics are listed in Appendix E.

With respect to ISO 9001 compliance, the Team specifically needs to:

- Know the GSFC Quality Policy and how it affects products and processes
- Have an easy access to all processes required for the job
  - ◊ All ISC projects must have written processes for performing their work functions that typically include development, testing, configuration Management, systems engineering, analysis, quality assurance, maintenance, and operations. The primary duties that you perform must have written processes describing how they are done.
  - ◊ Relevant processes for your job must be written, reviewed, approved (signed by an authorized person), available (you must have access), current (up to date), and followed
  - ◊ Know how processes you use are improved or changed. The use of defect analysis, customer feedback, internal reviews, and results from the overall measurement program help guide changes to all ISC and project processes
  - ◊ Know that a master document list identifying the acceptable processes for performing your job exists and must be used
- Discard or appropriately mark all outdated controlled documents
  - ◊ Documents that fall into this category are those contained in Product Plan master list or on the ISC master list. Each project must establish a related process.

- ◊ Old versions of controlled documents must be marked as obsolete or outdated. A simple handwritten identifier suffices.

- Know where project schedules for reviews and tests are identified
  - ◊ Tests (such as system tests or regression tests) and reviews (such as design reviews) must be identified and scheduled in the Product Plan
- Know how defects found in project products are recorded, tracked, corrected
  - ◊ As problems such as "bugs" are found in testing or in the inspection or review process, you must be aware of how such problems are handled for products you are working on. You must be able to refer to some written process that describes how that problem is handled.
- Be aware of and use inspection and test processes for products during development and before delivery
  - ◊ Almost all individuals on the Team participate in the generation of some intermediate or end product such as software, included data bases, data products, documents, or full systems. Each individual must be aware of what inspections take place and where that inspection is defined in a written process.
- Be able to produce records of all inspections, tests and reviews
  - ◊ There must be evidence that activities in your processes have been completed and recorded
  - ◊ Know where quality records are maintained
- Know how each unique version of a system or product is identified and controlled
  - ◊ Different versions of products such as software systems and documents under development or data files to be delivered must have some unique identifier to ensure that erroneous or incorrect versions are not used
- Know how you are qualified to do your work, how training is offered, and how work assignments are made
  - ◊ You are qualified to do your job because of your education and experience, which must meet GSFC job descriptions, and identifies any needed training to meet your work assignment. Each year the performance appraisal review reassesses your capabilities, including both formal and relevant OJT experiences.
  - ◊ A training handbook is provided each year listing available courses. Formal training records are kept in your personnel folder.
  - ◊ Be aware of how work is assigned to you and who assigns you work. Your work is assigned by your immediate supervisor.
- Follow the processes that pertain to your job and maintain appropriate records
  - ◊ The most important responsibility to ensure ISO compliance is for you to adhere to the processes that pertain to your job. Those processes designated for your use must be applied, and appropriate records must be kept as defined by the processes.

ISC Chief

From Section 2:

- Ensure a Team Lead is identified
- Ensure the Team Lead and Team consist of qualified individuals

From Section 3:

- Designates the ISC Management Team member responsible for the approval of any Product Plan covered by this handbook.

From Section 5:

- Establish a continuous improvement process for improving the Business Development Process and the Product Development Handbook

ISC Management Team

From Section 2:

- Develop individual skills, Team skills and centers of expertise
- Select and provide qualified Team Leads and Team members
- Define the Team and Team Leads responsibility, authority and accountability for delivering quality products
- Document any "required" training needs or OJT of employees in accordance with GPG 3410.2
- Ensure that training received using funds other than GSFC training funds is documented either in the employee's official or unofficial personnel folder

From Section 3:

- Ensure that the approaches taken by the Team stay aligned with ISC Strategic Implementation Plan
- Ensure that the Team obtains necessary resources in a timely and effective manner
- Reviews and approves the Team's Product Plan
- Effectively remove barriers which impede a Team's progress
- Ensure and defend the Team's empowerment rights throughout the process
- Document the process for reviewing and changing Product Plans (customer agreements)
- Facilitate support that the Team cannot provide themselves
- Ensure customer inputs for the Team Lead's performance plans and evaluations are made and maintained (appropriate supervisor)
- Ensure Team Lead's inputs for the Team performance plans and evaluations are made and maintained (appropriate supervisor)
- Provide training to Team members as requested by the Team Lead
- Document any identified training needs of employees on Performance Plan

- Ensures that training received using funds other than training funds is documented on the OHR Employee Training Records
- Document any required OJT on GSFC form 17-112 (see GPG 3410.2)
- Identify any specific processes requiring qualification (see GPG 3410.2)
- Allocate resources as requested by the Team and approved

From Section 5:

- Ensure the ISC Quality Manual (i.e., the Product Development Handbook) remains aligned with the GSFC Quality Manual
- Review GSFC Quality Management System as requested for recommended improvements
- Ensure alignment of organization to the ISC Quality Manual
- Define responsibilities and authority for delivering quality products

ISC/ISO Representative

From Section 6:

- Represent ISC at the Directorate level in all matters concerning ISO 9001 certification implementation and maintenance
- Direct all activities pertaining to ISO 9001 within ISC
- Overall responsibility for maintaining the ISC Quality Manual (Product Development Handbook)
- Review newly developed Team Processes specified in the Product Plan
- Overall responsibility for adding/deleting/maintaining the ISC Library of Approved Team Processes
- Review newly developed Team Processes specified in the Product Plan
- Overall responsibility for adding/deleting/maintaining the ISC Library of Approved Team Processes

ISC Document Configuration Manager

From Section 6.1:

- Assign identification numbers for quality records, documentation and data
- Maintains a list of ISC level quality records and configuration controlled items, date or identification number/letter, their locations and their owners
- Obtains approval for deletion of items from controlled list from the ISC Management Team

Available Contracts Data Base Administrator

From Section 3:

- Maintain a data base of current contracting mechanisms (hardware, software, manpower) that have demonstrated acceptable performance
- Details of the information and format for this database may be found in the Supplier Performance Records, GPG 5100.2

System Support Team (TBD)

From Section 3:

- Maintain the organizational knowledge
- Provide support to Teams as requested

Appendix D: Required Team Processes & Functions

Below are listed the criteria for Team processes required to be defined in the Product Plan. This definition of processes may be done by reference acceptable existing Team processes located at http://isc.gsfc.nasa.gov/Iso9k/ISO9001.htm or by direct inclusion in the Product Plan itself. Below each process name in this section are listed the criteria required for ISO 9001 compliance that must be performed in the process. The Team may develop their own process as long as the criteria listed here are satisfied. The ISC/ISO Representative has the responsibility for independently reviewing the Team Product Plans to ensure that the processes defined are ISO 9001 compliant. New processes documented by Teams and found to be ISO compliant, will be added to the acceptable Team Processes database by the ISC/ISO Representative for use by reference by subsequent Teams (see process in Section 6.2).

Criteria 1 - Development Methodology (GPG 8072.1)

1. Are requirements documented and agreed upon between customer and Team?

2. Are changes to requirements and software documented according to Team configuration management process?

3. Is Team collecting and documenting an agreed upon set of metrics in order to manage the development?

4. Is Team developing a proposal for method of satisfying customer requirements, determining use of Off-the-Shelf or new development, and considering customer's cost, schedule and quality? Is proposal reviewed with and approved by customer?

5. Have organizational and technical interfaces between different groups which input into the design process been defined?

6. Does the design output identify those characteristics in the design that are crucial to the safe and proper functioning of the product?

7. Are records of design reviews maintained as quality records?

8. Are design verification measures recorded? (quality records)

9. Are design changes and modifications identified, documented, reviewed and approved by authorized personnel prior to their implementation?

10. Is Team verifying design against customer requirements and documenting the results?

The following are methods of performing such reviews: a) reviews such as preliminary or critical design reviews, b) Team reviews, c) design walkthroughs, d) prototyping

11. Has Team selected a development methodology to control the quality of the software being developed? A methodology addresses design, development, testing and delivery of a system.

Methodology may also address the following:

- Programming rules
- Programming language
- Naming conventions
- Standards for commentary (program design language, comments).
- Code reading

12. Are software deliveries tested against customer requirements and results documented?

13. Are delivery schedules and contents of software deliveries agreed upon with the customer and the Team and documented? Is test status of the delivery discussed with the customer prior to delivery and documented?

Criteria 2A - Control of Documents and Data (GPG 1410.1)

These questions shall be addressed for this process:

1. Is there a documented process for control of all documents and data that relate to the quality system?

2. Does the document control process include documents of external origin such as standards and customer requirements?

3. Are documents and data reviewed and approved by authorized personnel prior to use?

4. Is there a master list or equivalent document control process that identifies the current revision status of documents and is it readily available?

5. Do controls ensure that:

   a) Pertinent issues of appropriate documents are available at all locations where operations essential to the effective functioning of the quality system are performed?

   b) Invalid and/or obsolete documents are promptly removed from all points of issue or use, or otherwise assured against unintended use?

   c) Any obsolete documents retained for legal and/or knowledge-preservation purposes are suitably identified?

6. Are changes to documents and data reviewed and approved by the same function/organization that performed the original review and approval?

7. If specified otherwise, do the designated functions/organizations have access to pertinent background information upon which to base their review and approval?

8. Is the nature of the change identified in the document or appropriate attachment where practicable?

Criteria 2B - Control of Quality Records (GPG 1440.7)

1. Has the supplier established documented processes for control of quality records and does this process include: a) Identification? b) Collection? c) Indexing? d) Access? e) Filing? f) Storage? g) Maintenance? h) Disposition?

2. Are quality records maintained to demonstrate conformance to specified requirements and the effective operation of the quality system?

3. Are pertinent quality records from subcontractors an element of this data?

4. Are all quality records legible?

5. Are all quality records stored and retained in such a way that they are readily retrievable?

6. Are all quality records stored in facilities that provide suitable environment to prevent damage or deterioration and to prevent loss?

7. Are quality records made available for evaluation by the customer or customer's representative for an agreed period, where agreed contractually?

Criteria 3 - Control of Customer Supplied Elements (GPG 5900.1)

1. Have documented processes been established for control of verification, identification, storage and maintenance of customer supplied product?

2. Do the processes for customer supplied product include provisions for recording and reporting to the customer a product that is lost, damaged or otherwise unsuitable for use? (For projects, use the NCR/CA system)

Criteria 4 - Identification and Traceability of Products (GPG 5310.4)

Traceability should include how builds and releases are identified including identification of components that comprise the build or release.

1. Are documented processes established for identified items and products by suitable means from receipt and during all stages of production, delivery and installation?

2. Are documented processes available for traceability where appropriate?

3. When traceability is a specified requirement is the product thereof uniquely identified?

4. Is this identification recorded?

Criteria 5 - Product Inspection and Test Approach (GPG 5330.1)

1. Has the supplier established documented processes for inspection and testing activities in order to verify that the specified requirements are met?

2. Does the quality plan or documented process state the required inspection or tests and the records to be established?

3. Does the supplier ensure that incoming product is not used or processed until it has been inspected and determined to be conforming? (Except in circumstances as noted below in question 6)

4. Is verification of conformance to the specified requirement in accordance with the quality plan and/or documented processes? All inspection of Commercial-Off-the-Shelf products should be based on kind, count, and condition unless specified otherwise in the procurement. See GPG 4520.2. All problems with incoming products should use processes defined in Criteria 6. Results of all inspections are quality records.

5. Is consideration given to the amount of control exercised at the subcontractor's premises and recorded evidence of conformance when determining the amount and nature of receiving inspection?

6. If incoming product is released for urgent production is it positively identified and recorded in order to permit recall and replacement in the event it is later determined to be nonconforming?

7. Is the product inspected and tested as required by the quality plan or documented processes?

8. Is product held until the required inspections and tests have been completed or necessary reports have been received and verified? (Except as noted in question 6 above)

9. Are all final inspections and test carried out in accordance with the quality plan and/or documented processes?

10. Do quality plans or documented processes require that all specified inspections and tests (including receiving and in-process inspections and tests) have been carried out and the results meet specified requirements?

11. Do the suppliers processes ensure that no product is dispatched until all activities specified in the quality plan or documented processes have been satisfactorily completed and the associated data and documentation is available and authorized?

12. Are records established and maintained which provide evidence that the product has been inspected and/or tested?

13. Do the records clearly show whether the product has passed or failed the inspection and/or tests according to defined acceptance criteria?

14. Do records identify the inspection authority responsible for release of the product?

Criteria 6 - Control of Test Equipment and Software (GPG 8730.1)

1. Are documented processes established to control, calibrate and maintain inspection, measuring and test equipment (including test software) that is used to demonstrate the conformance of the product to the specified requirements?

2. Is inspection, measuring and test equipment used in a manner which ensures that the measurement uncertainty is known and is consistent with the required capability?

3. Is test software or comparative references such as test hardware checked to prove that they are capable of verifying the acceptability of product prior to release for production, installation or servicing?

4. Is test software of comparative references such as test hardware rechecked at prescribed intervals?

5. Has the supplier established the extent of such checks and are records of these checks maintained?

6. Is technical data pertaining to inspection, measuring and test equipment made available to the customer or customer's representative when this is a specified requirement?

7. Has the supplier determined the measurements to be made and the accuracy required?

8. Are the appropriate inspection, measuring, and test equipment selected that are capable of the necessary accuracy and precision?

9. Is all inspection, measuring, and test equipment that can affect product quality identified, calibrated and adjusted at prescribed intervals, or prior to use, against verified equipment having a known valid relationship to internationally or nationally recognized standards?

10. Where no such standards exist is the basis for calibration documented?

11. Has the process to be employed for calibration of inspection, measuring, and test equipment been defined? Including details of: a) Equipment type? b) Unique identification? c) Location? d) Frequency of checks? e) Check method? f) Acceptance criteria? g) Action to be taken when results are unsatisfactory?

12. Is inspection, measuring and test equipment identified with a suitable indicator or approved identification record to show the calibration status?

13. Are calibration records maintained for inspection, measuring and test equipment?

14. Is the validity of previous inspections and test results assessed and documented when inspection, measuring and test equipment is found to be out of calibration?

15. Does the supplier ensure that the environmental conditions are suitable for the calibration, inspections, measurements and test to be carried out?

16. Does the supplier ensure that the handling, preservation and storage of inspection, measuring and test equipment is such that the accuracy and fitness for use is maintained?

17. Are inspection, measuring and test facilities, including both test hardware and test software, safeguarded from adjustments which would invalidate the calibration testing?

Criteria 7 - Control of Nonconforming Product (GPG 5340.2)

1. Has the supplier established a documented process to ensure that product that does not conform to specific requirements is prevented from unintended use or installation?

2. Does the control provide for: a) Identification? b) Documentation? c) Evaluation? d) Segregation (when practical)? e) Dispositioning?

3. Does the control provide for notification of the functions concerned?

4. Is the responsibility for review and authority for the disposition of nonconforming product defined?

5. Is nonconformance documented in the on-line Nonconformance Form and information on the use of the form is found in the GSFC GPG 5340.2 located at http://arioch.gsfc.nasa.gov/iso9000? This form should be used only for those nonconformities specified in the GPG 5340.2. All nonconformities shall be retained in the Product Team's database. Nonconformities at the Project level should begin when a new release has been delivered to the customer. All nonconformances shall be cross-referenced to the software product work authorization form.

6. Is nonconforming product reviewed in accordance with documented processes? Are the following options considered? a) Rework to meet the specified requirements? b) Accept with or without repair by concession? c) Regrade for alternative standards? d) Reject or scrap?

7. When required by the contract, is the proposed use or repair of the product, which does not conform to specified requirements, reported for concession to the customer or the customer's representative?

8. Is the description of the nonconformity that has been accepted, and of repairs, recorded to denote the actual conditions?

9. Is repaired and/or reworked product reinspected in accordance with the quality plan and/or documented processes?

Criteria 8 - Preventive and Corrective Action (GPG 1710.1)

Product Teams are expected to have their own documented corrective and preventive action process with attributes described below. However, any nonconformance which meets the criteria specified in the Control of Nonconforming Products (GPG1710.1) and has been entered into the Project Nonconformance Report database will be tracked and closed out by the Project, using the processes described in GPG 1710.1.

1. Does the supplier have documented processes for implementing corrective and preventive action?

2. Is the magnitude of the problem and the risks encountered taken into account when corrective and preventive action is taken to eliminate the causes of actual or potential nonconformities?

3. Are changes to the documented processes resulting form corrective and preventive action implemented and recorded?

4. Do the processes for corrective action include: a) The effective handling of customer complaints and reports of product nonconformities? b) Investigation of the cause of nonconformities relating to product, process and quality system, and recording the results of the investigation? c) Determination of the correction action needed to eliminate the cause of nonconformities? d) Application of controls to ensure that corrective action is taken and that it is effective?

5. Do the processes for preventive action include: a) The use of appropriate sources of information such as: i) Processes and work operations which affect product quality, ii) Concessions, iii) Audit results, iv) Quality records, v) Service records, vi) Customer complaints to detect, analyze and eliminate potential causes of nonconformities? b) Determination of the steps needed to deal with any problems requiring preventive action? c) Initiation of preventive action and application of controls to ensure that is effective? d) Ensuring that relevant information on actions taken is submitted for management review?

Criteria 9 – Process for Product Maintenance

1. Where servicing (maintenance) is a specified requirement, has the Team established documented processes for: a) Performing, b) Verifying, c) Reporting that servicing meets the specified requirements?

Criteria 10 - Process for Process and Product Metrics Analysis (GPG 1710.1)

1. Has the Team identified the need for statistical techniques required for a) Establishing b) Controlling c) Verifying process capability and product characteristics?

2. Has the Team established documented processes to implement and control the application of the statistical techniques identified above?

3. Has the Team identified the method to used to analyze the collected metrics from the product production and the method by which such analysis information will be fed back into the improvement of the process for the next production process?

Appendix E: Mandatory Team Metrics

Table 1 lists the required(1) metrics which all Product Teams are expected to collect, record, and periodically analyze for process improvement potential. The intent is to reduce the number of parameters to a set that is meaningful to the team in managing, assessing, and improving their own internal performance. Since many teams have not previously been required to collect metrics in any specific format or units and are in mid-development, the Team Lead may specify in the product plan the format and units of the metrics collected and the frequency at which they are collected. Table 2 provides a recommendation for the units of the metrics and the frequency of their collection. The information will be analyzed across similar and dissimilar activities to assess best practices and help identify potential for process improvements.

Metric Group	Metric
Project	Name
Schedules	Major milestones (including reviews, test dates, release and build delivery dates) (2) Quantification of progress (3)
Cost	Budget in dollars, under the responsibility of the Team Civil service effort (4) Contractor effort (4)
Quality	Open problem reports (5)

Table 1 - Required Metrics

Notes:

(1) If it is determined that this set of metrics is not meaningful an exception for the collection of some or all of these metrics may be granted by the appropriate Branch Head. Metrics are not meaningful if the Team or ISC cannot use them for managing, assessing, or improving the team's internal performance; or for comparison with similar Teams to assess the effectiveness of ISC processes. This exception will be specifically documented in Section 4.3 of the Team's Product Plan.

(2) Expected project milestones should be recorded as part of the design planning activities.

(3) Quantification of progress may be kept in one of the following ways:

a) By using an earned value system, with each activity assigned a relative weight (or number of points)

b) As a checklist of activities to be completed versus those completed

c) As a collection of regular periodic progress reports

(4) Civil service (or contractor) effort may be recorded in staff months or as a percentage of the total time a person is assigned to the Team. Civil Service effort may be based on requested support instead of actual accumulated manpower if not readily accessible, but should reflect actual personnel assignments when the two significantly deviate.

(5) Open problem reports should be the number of unresolved problems or discrepancies listed in the minor NCR/CA system or the Goddard NCR/CA system.

Metric Group	Metric	Units	When Recorded (1)
Project	Name	Names	At project start
Schedules	-Planned major milestones. Should include the following: Reviews Documentation (including ICDs) Tests Releases/builds Procurements External Deliveries to Team -Actual major milestones. See above -Quantification of progress	 Milestone Dates Start/Stop Dates Start/Stop Dates Start/Stop/Delivery Dates Start/Key/Delivery Dates Milestone Dates Same as above Earned value point system	-During project planning activities -Schedules should be updated for changes in plan -At completion of milestone -On a continuing basis
Cost	-Budget for: COTS hardware COTS software COTS software maintenance COTS hardware maintenance -Civil service manpower estimated(2) -Civil service actual(3) -Contractor manpower estimated -Contractor manpower actual -Training (4) -Travel	 Dollars by fiscal year Dollars by fiscal year Dollars by fiscal year Dollars by fiscal year Staff months Staff months Staff months Staff months Number of classes Number of trips	-Initial planned budget numbers should be recorded during the project planning activities. Budget expenditures should be monitored on a periodic basis and compared with the planned budget
Non Conform-ances (5)	-Open nonconformances -Number of nonconformances due to: >requirements misinterpretation >missed requirements > improper implementation > poor performance >Cosmetic	Numbers and severity Numbers and severity Numbers and severity Numbers and severity Numbers and severity Numbers and severity	-On a continuing basis -On a continuing basis
System Changes (6)	-Number of changes due to: >New requirements >Modified requirements >Deleted requirements	Number	-On a continuing basis

Table 2: Recommended Metrics

Notes:

1) Unless otherwise noted, metrics are collected at the project start, at key reviews and releases. Maintain a log of reasons for changes.

2) Estimated Civil Service effort may be based on requested support.

3) Actual Civil Service manpower should reflect actual personnel assignments if actual accumulated manpower is not readily available.

4) Training should represent the number of classes that Team members plan to and/or have taken (if two people take the same class, that counts as 2 classes).

Travel should represent the number trips that Team members plan to and/or have taken (if two people go on the same trip, that counts as two trips).

5) This is to include errors only, not Customer requested changes to the system (see System Changes). For each type of error, include the cumulative number that have been identified and the cumulative number that have been recorded in the GSFC NCR system.

Also for each non-conformance, record the level of severity, where “High” implies that the software problem(s) are serious and cannot/should not be used, where “Medium” implies that the problem is serious but that the software is usable (possibly with work-around), and where “Low” implies the problems are not serious.

6) These are Customer directed changes that may result in a change to cost, schedule and/or size, and should be logged as required. Only the number of times this has occurred is to be recorded, NOT actual number of requirement changes. There is no attempt to normalize changes, but to just record the number of times redirection has occurred, even if proposed by the Team and accepted by the Customer.

Appendix F: References

1. Product Development Handbook

   http://isc.gsfc.nasa.gov/Iso9k/pdh/PDH.pdf

2. Strategic Implementation Planning Process

   TBD

3. Yearly Action Planning Process

   TBD

4. Library of Approved Team Processes

   http://isc.gsfc.nasa.gov/Iso9k/ISO9001.htm

5. GSFC ISO 9001 Quality Manual

   http://arioch.gsfc.nasa.gov/iso9000/index.htm

Appendix G: Acronym List

AETD	Applied Engineering and Technology Directorate
CA	Corrective Action
COTS	commercial off-the-shelf
GOTS	government off-the-shelf
GPG	Goddard Procedure and Guidelines
GSFC	Goddard Space Flight Center
ICD	interface control document
ISC	Information Systems Center
ISO	International Organization of Standardization
NASA	National Aeronautics and Space Administration
NCR	Non-Conformance Report
OBE	on-board equivalent
OHR	Office of Human Resources
OJT	on the job training
PD	position description
PG	Procedures and Guidelines
QM	Quality Manual
QMS	Quality Management System
RFA	Requests for Action
RITS	Receiving Inspection and Test System
S/W	software
TBD	to be determined
URL	uniform resource locator
WOA	Work Order Authorization